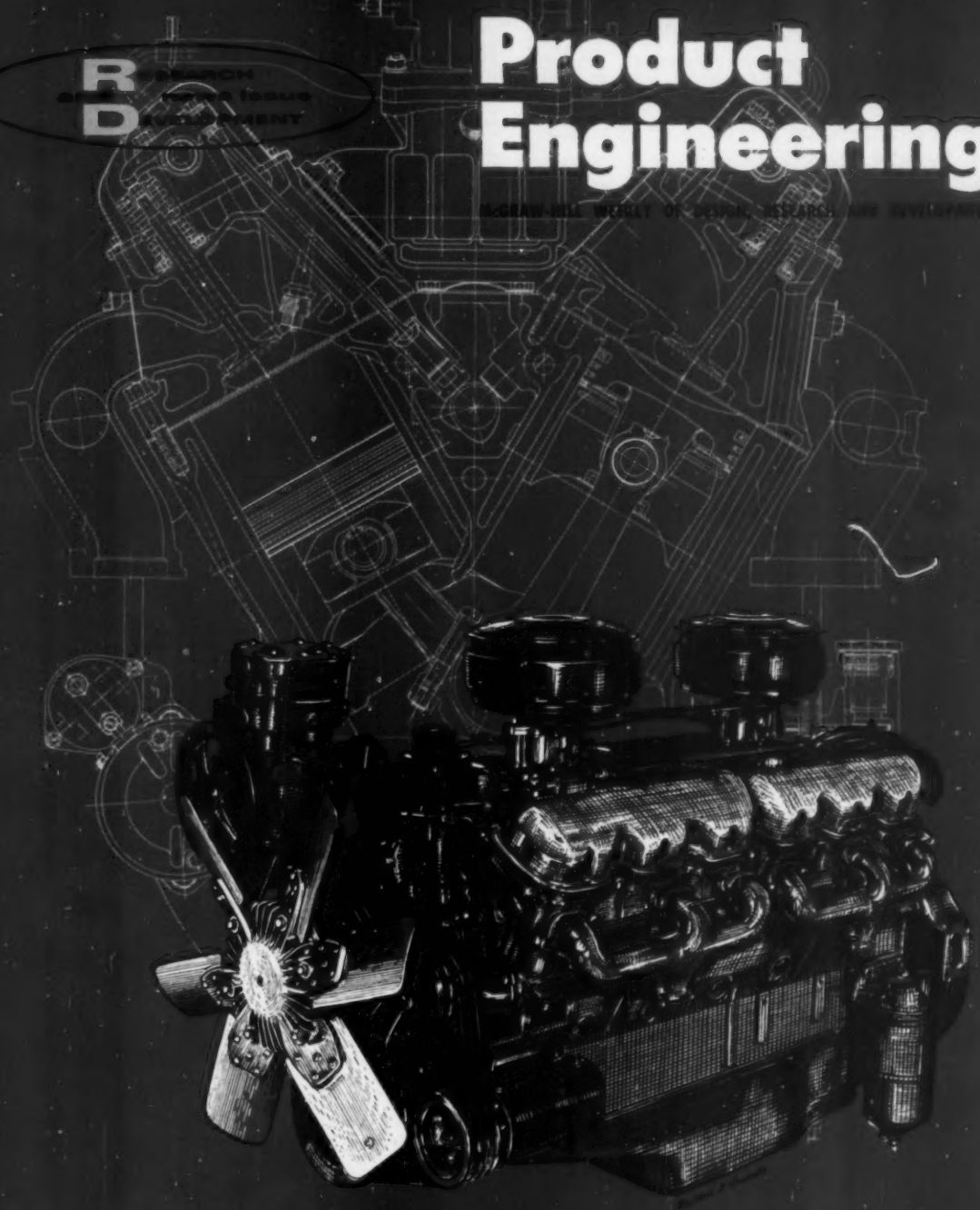
AUGUST 10, 1959

R D Research and Development issue

Product Engineering

McGRAW-HILL WEEKLY OF DESIGN, RESEARCH AND DEVELOPMENT



TWO V-6's make ONE V-12

see page 21

How the East German engineer lives and works

see page 38

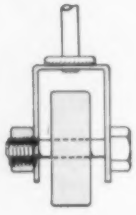
THE LIQUID LOCK FOR METAL PARTS

. . . improves fastener reliability and reduces costs!

LOCTITE sealant makes ordinary fasteners into lock fasteners at savings of 40%-70%. Locking action extends over the entire engaged area providing unequalled resistance to vibration . . . ends breakdowns due to loosening of fasteners. A single drop of LOCTITE replaces all sizes of lock nuts, lock washers, lock screws, jam nuts, staking and interference threads.

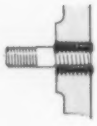
– ELIMINATES LOCK WASHER OR SELF-LOCKING SCREW

Makes ordinary screws into lock screws. Several times the holding power at savings of $20/M.



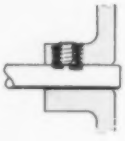
– ELIMINATES SELF-LOCKING NUT OR JAM NUT

Locks non-seated nuts anywhere along the length of thread.



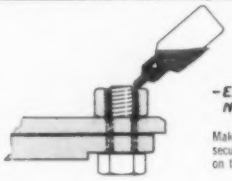
– ELIMINATES INTERFERENCE FIT

Locks studs securely . . . locking action develops after stud is in place . . . allows easy-driving Class 2 threads. End stripped threads, broken studs, damaged castings.



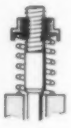
– ELIMINATES DOUBLE SET SCREWS, SELF-LOCKING SET SCREWS, JAM NUTS ON EXTENDED SET SCREWS OR STAKING

LOCTITE-treated set screws cannot vibrate loose . . . end nuisance service calls.



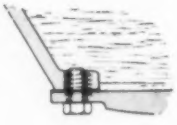
– ELIMINATES SELF-LOCKING NUT OR LOCK WASHER

Makes any nut a lock nut. Saves 40%-70%. Holds securely where lockwashers fail. Does not depend on tightening torque for locking action.



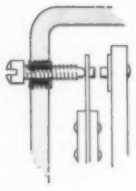
– ELIMINATES SPECIALS OR STAKING

Makes any threaded part self-locking.



– ELIMINATES BLIND HOLE TAPPING, SPECIAL LEAK-PROOF FASTENERS

LOCTITE locks and seals threaded parts against vibration and high-pressure fluids.



– ELIMINATES SELF-LOCKING SCREW OR JAM NUT

Get the right setting the first try . . . no backlash. LOCTITE provides the proper amount of drag to hold adjustment securely. Permits repeated adjustments.

LOCTITE Sealant is easy to apply . . . simple to automate

Labor savings are obtained when several days supply of threaded parts are treated by tumbling with LOCTITE Sealant. Treated parts store for days, lock only when assembled. Smaller quantities may be tumbled by hand in polyethylene bags. Parts may be individually treated using applicator nozzle on LOCTITE bottle or by using continuous feed tube. Parts may be treated *after* assembly, LOCTITE wicks into threads by capillary action.

LOCTITE is a thin liquid that hardens into a tough heat and oil-resistant seal when confined between closely fitting metal parts. It requires no heating or mixing . . . does not air dry. LOCTITE comes fully prepared . . . stores for years . . . hardens only when treated parts are assembled. Ten grades provide any desired torque to all sizes and types of fasteners. LOCTITE-treated fasteners may be removed with ordinary tools . . . fasteners may be re-used.

LOCTITE Kit No. 10-10

Contains 10 grades of Loctite sealant specially put up to assist engineers in determining proper grade of Loctite in product development and for general experimental work. By selection of proper grade, the designer can apply a pre-determined amount of locking torque.

Write for literature and free sample.

LOCTITE® SEALANT

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AMERICAN SEALANTS COMPANY • 119 WOODBINE ST., HARTFORD 6, CONN.

NEXT WEEK
THE DESIGN ISSUE
FOR AUGUST 17
WILL HAVE AN
EXCLUSIVE
FULL-COLOR
FEATURE ARTICLE

DESCRIBING

PORCELAINIZED CAST ALUMINUM

How industry can take advantage of its excellent heat and wear resistance **plus** the beautiful colors and textures possible with this method of applying low-temperature frits to permanent-mold aluminum castings.

and coming in September . .

WHEN EQUIPMENT SAYS IT IN

COLOR

ASA and National Safety Council color codes. How they look, what they mean and how they're used to convey information quickly and clearly.

Full-color articles are a regular feature in **Product Engineering.**

DON'T MISS THEM.

coming next week

the DESIGN issue

for August 17

FEATURING

- **Porcelainized cast aluminum**
  Low-temperature frits can now be applied to permanent-mold castings as well as to sheet aluminum.

- **Fiberglass sleeve-springs for high energy absorption**
  They can handle almost five times more kinetic energy from impact than equivalent steel springs.

- **Aluminum forgings for precision tolerances**
  Here's what design can expect in standard and precision tolerances from these parts.

- **Fluid-flow models predict design performance**
  How models are used to check design calculations, and to make sure that the fluids behave as planned.

- **Saving space with the liquid spring**
  Proved out in aircraft, liquid springs are ready to move into trucks and cars.

- **Forces in helical, bevel and herringbone gear**
  Charts for thrust, radial and overhung loads.

Product Engineering

McGRAW-HILL WEEKLY OF DESIGN, RESEARCH AND DEVELOPMENT

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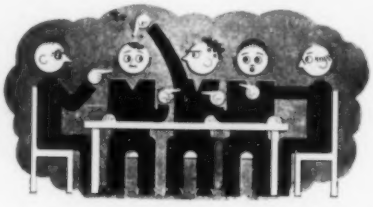
● **Comparative incomes of East German engineers** (p 38) and Americans reflect the relatively low standard of living in Soviet-controlled countries. However, the differences are not as extreme as simple dollar conversions make it appear. Communist and Socialist countries offer free, or very inexpensive, medical care. Housing is cramped, but it costs only about 5% of the family income. Income taxes are generally lower than ours. Also, the quality of product or service may be overlooked. There is a vast difference between a hand-tailored suit or woman's dress and a ready-to-wear model (ask your wife). The only way to learn how a foreigner lives is to visit his country, and then judge by *his* set of values, not by your own.

● **This sketch, over a different caption,** was taken from the *Sheffielder*, a publication of the Sheffield Corp. We couldn't resist adding our own interpretation of how most troubleshooting sessions end up. It may be a waste of engineering time (p 44) but how human!



I cannot tell a lie . . . he did it.

● **The "Nega-gage" is a new strain gage** whose characteristics are exactly the reverse of standard gages, say the editors of the Society for Experimental Stress Analysis *Newsletter*. "It comes in negative lengths from $-\frac{1}{4}$ in. to $-\infty$, and can be employed for static or dynamic strains of negative frequency—that is, in the negacycle range. The Nega-gage, having a negative gage factor and negative resistance, naturally requires a negative power supply and a Wheatstone tunnel circuit which has the useful characteristic of always remaining balanced, regardless of strain. One reads the strain by merely unbalancing the indicator manually by the desired amount . . . probably the only strain indicator in existence capable of always indicating the analytically predicted strain."

ABP August 10, 1959

PRODUCT ENGINEERING
A McGRAW-HILL PUBLICATION

Vol. 30, No. 32

ABC

PRODUCT ENGINEERING is published weekly—with an additional Design Digest Issue in Mid-September, by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. PUBLICATION OFFICE, 99-129 North Broadway, Albany 1, N. Y. See panel below for directions regarding subscription or change in address.

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United States subscription rates for individuals in the field of the publication, $5.00 per year, single copies 50 cents; Canadian subscriptions $7 per year; foreign $25 per year, payable in advance. Second-class postage paid at Albany, N. Y. U.S.A.

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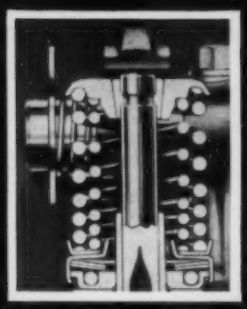
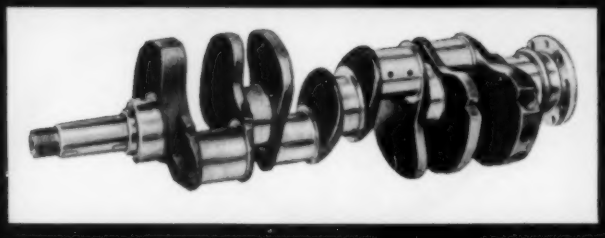


POSITIVE ROTATORS
on all exhaust valves

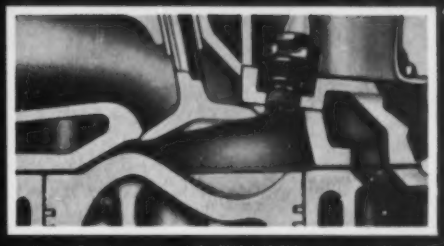
UV-549
257 max. eng. hp.

HEAVY-DUTY LUBE
OIL COOLER is
standard equipment

COUNTERBALANCED
CRANKSHAFT
is rigid, deflection-free



MACHINED COMBUSTION
CHAMBERS for uniform
compression ratio in all cylinders



Get more power per dollar with V-8's that rank first in 206 to 257 hp. class

Three new International V-8's—the UV-549, UV-461 and UV-401—are power, price and performance leaders in the 206 to 257 max. engine horsepower classification. Each of the three heavy-duty models give you more power per dollar...the surest way to put an extra sales feature in your products. And the power curves for these better breathing V-8's are certified—not hopeful guesses of what the engine may or may not deliver.

Each engine is available with factory-installed carburetion equipment to burn the fuel of your choice—gasoline, LPG or natural gas.

Get complete details on any of these No. 1 rated V-8's by writing or calling International Harvester Co., Engine Sales Department, Construction Equipment Division, Melrose Park, Illinois.

CIRCLE NO. 5 READER SERVICE CARD

BRIEF SPECIFICATIONS

MODEL	UV-549	UV-461	UV-401
Eng. Max. Hp. (gaso.)	257 @ 3400 rpm	226 @ 3600 rpm	206 @ 3600 rpm
Power Unit Net hp:			
gaso	208 @ 2600 rpm	170 @ 2600 rpm	160 @ 2800 rpm
LPG	201 @ 2600 rpm	166 @ 2600 rpm	155 @ 2800 rpm
nat. gas	178 @ 2600 rpm	153 @ 2600 rpm	132 @ 2800 rpm
Bore and Stroke	4½ x 4¾	4⅛ x 4¾	4⅛ x 3¾
Displacement cu in.	549	461	401

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A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

ECONOMY AND STRENGTH are outstanding characteristics of these pressure plates for automotive transmissions. These sintered metal parts are another typical result of the effective liaison between Moraine Products and customer in product design. They also confirm Moraine Products' talent for producing—in quantity and on time—parts that can take the punishment of the most demanding operating conditions.

Parts shown ⅓ actual size

Vital parts for Industrial Progress

Moraine Products
Division of General Motors, Dayton, Ohio

DEVELOPMENTS TO WATCH...

American

Flexible zinc-silver-chloride batteries that can be spliced . . .

. . . right into communications cables are now ready for production, says Aerojet-General Corp. Developed for the Signal Corps, these "snake" batteries are indeed snake-like in appearance. They're made of silver-chloride links and zinc segments, separated by rubber rings, and are about 30 in. long. A wire, spiraling down the unit, connects the separate sections into a sausage-like chain.

According to Aerojet, the battery, in a ⅝-in.-dia size, will deliver 5 ma at 1 v continuously for a year; but it can be made in "any size," with a delivery rate of "more than 40 w-hr/lb."

First application will be in powering transistorized submarine communications-cable repeaters.

Amorphous graphite with low ash content . . .

. . . suitable for use in lubricants, molded parts, pigments and high-temperature applications where "amorphous graphite is not presently acceptable" is being produced in pilot quantities at Colorado School of Mines Research Foundation, working under a Superior Graphite Co research contract.

Sample quantities of the material may be obtained from C. J. Lewis, CSMRF Chemical Div manager.

Dielectric systems can be effective . . .

. . . even where magnetic and density methods fail: in separating such particle mixtures as zircon and rutile, silicon carbide and alumina, silicon carbide and silica; and in dividing mixtures of various-sized particles of such materials as polyvinyl chloride into their individual components, researchers at Princeton U Plastic Laboratory report.

At the Electrochemical Society meeting (*PE—June 1, p 14*) Herbert A. Pohl and C. E. Plymale described two types of dielectrophoretic cells which had been successfully applied: one, a cell with cylindrically symmetrical electrodes; the other, an "isomotive cell" with electrodes so designed that "the force upon the particles does not depend upon geometrical position in the channel in which the particles move and they can move freely in suspension.

In both cases, the particles are suspended in a dielectric organic liquid (carbon tetrachloride, cyclohexane, benzene, or the like) and a pulsating current—either dc or ac—is applied. For effective separation, voltage must be held within certain critical limits; and, say Pohl and Plymale, "best results are obtained if the dielectric constant of the suspended solids exceeds that of the liquid dielectric."

Of the two types of cells, Pohl now favors the isomotive. Research since the ECS report was prepared, Pohl says, indicates that it should be particularly versatile and adaptable to continuous operation.

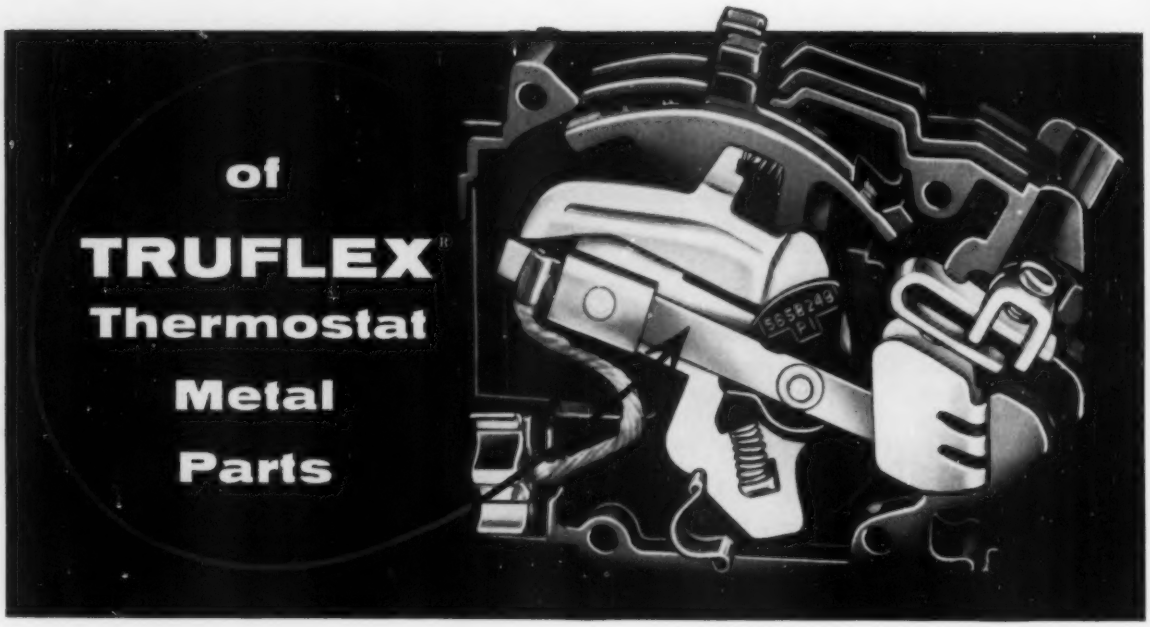
Cast nylon gears, in sizes to 2 ft . . .

. . . will soon be available from Reeves Bros Inc, as the first commercial application for the recently announced Reeves casting technique that is said to cut tooling costs to a fraction of those for conventional molding methods. This, says Reeves, will make it possible to produce gears and other parts, particularly in small quantities, at a surprisingly low cost per unit.

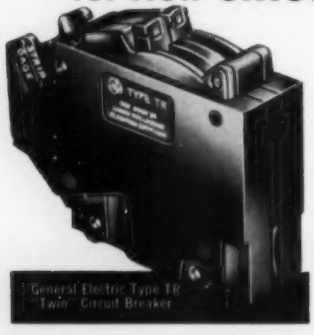
Other advantages claimed for parts made by the new method are greater density, greater strength, and longer service life. —ARG

Cast nylon crown gear is typical of parts which can be made by new technique. Here, it's installed on textile loom.

Accurate, Consistent Performance



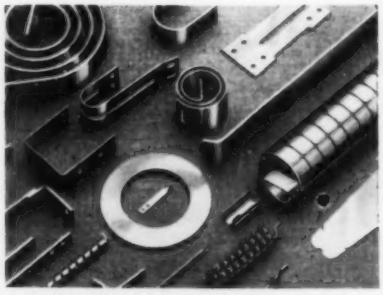
Meets General Electric's High Material Performance Requirements for New CIRCUIT BREAKERS



The new General Electric "Twin"* Circuit Breaker for household applications combines two rugged breakers into a single one-inch case to allow up to twice as many circuits per load center. Because quality and dependability are a must, General Electric Circuit Protective Devices Department used TRUFLEX Thermostat Metal parts in their Type TR "Twin"* Circuit Breakers.

TRUFLEX is available in cut strips or long-length coils to meet your needs, or can be furnished in formed elements or completed assemblies fabricated to the most exacting parts' specifications. Either way you get accurate, consistent performance with TRUFLEX because every repeat order is an exact duplicate of the original — dependably uniform in activity, temperature range, electrical and corrosion resistance.

To new or regular users of thermostat metal, Metals & Controls has much to offer — over 60 types of TRUFLEX Thermostat Metal (resistivity from 15 to 850 ohms per c.m.f.) — complete technical literature on TRUFLEX — help with parts design — calibrated samples. Our competent field engineers will gladly call at your request. No obligation. Write today.



A few typical TRUFLEX formed elements fabricated for many Metals & Controls' customers.

*"Twin" Registered Trademark General Electric Company

METALS & CONTROLS

1008 FOREST STREET, ATTLEBORO, MASS., U.S.A.

A DIVISION OF TEXAS INSTRUMENTS INCORPORATED

GENERAL PLATE PRODUCTS: Clad Metals • Electrical Contacts • Truflex® Thermostat Metal • Platinum Metals • Reactor Metals • Radio Tube & Transistor Metals

DEVELOPMENTS TO WATCH...

World-wide

More powerful permanent magnets . . .

. . . are promised by research now in progress at Forschunginstitut fur Edelmetalle und Metallchemie, Schwabisch, Gmünd, Germany. Johnson, Matthey & Co Ltd, British platinum producer, reports that the German group, working under Prof Ernst Raub, has prepared alloys of platinum, palladium, rhodium and iridium with iron, cobalt, and nickel that "develop higher values of coercive force and can produce more powerful magnets than any other known permanent-magnet material." Basic research on these alloys is now concentrating on optimum processing temperature for magnetic properties.

More data on the new Dutch method for hardening glass . . .

. . . (*PE*—Feb 23, p 14) indicates it puts into practice a scientific fact long known, but apparently never applied on a commercial basis: Glass, when first produced, is exceedingly hard and tough. But, almost immediately, microscopic cracks begin to develop in its surface, which rob it of much of its strength and impact resistance.

This cracked surface layer may be removed mechanically or physically; but, say the Dutch, such removal often creates more trouble than it cures.

In the new process, pioneered by Glasindustrie F. v. Tetterode, 6-12 Ant. Heinsiusstr, Amsterdam, the surface layer is dissolved in an acid bath through which hydrofluoric acid is blown at high pressure. A silicone rinse then completes the treatment and protects the surface from further cracking.

Glass sheet as much as 20 times stronger than present materials can be produced this way, the Dutch claim; and the treatment is inexpensive and adaptable to commercial production.

Canadian government patents available for licensing . . .

. . . are now being listed in a Patents Handbook, just as our own AEC declassified patents are. Developments recently released include:

- A control-cable actuating device said to prevent accidental operation caused by temperature variation or flexing of the basic structure, yet free to operate under specific design conditions.
- A process, for plating nickel on nonferrous metals, which is said to eliminate the need for pretreatment other than simple cleaning. Says the patentee, J. T. N. Atkinson, "the plating solution has a high dissolving power which removes the oxide of the cathodic metal, while having no appreciable effect on the cathodic metal itself."
- A device, for mounting transistors on printed-circuit chassis, that is said to combine exceptionally good heat conduction with adequate electrical insulation.

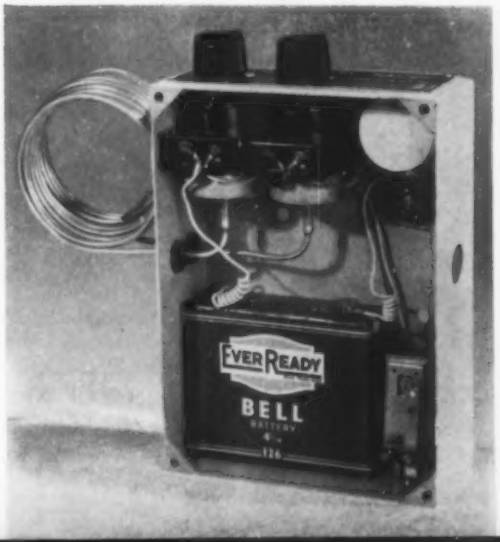
Information on these and other patents may be obtained from Canadian Patents and Development Ltd, Ottawa 2. The items noted here are numbered 1957, 2717, and 2575.

Battery-powered, dual-temperature alarm . . .

. . . that can be factory-set to signal when the temperature falls below one point or rises above another is being introduced by Teddington Refrigeration Controls Ltd, Sunbury-on-Thames, England.

The unit consists simply of two capillary-type thermostatic switches, a magnetic relay, a buzzer, and a dry cell; and is designed for installation outside the monitored space.

First models were developed specifically for blood bank use and are designed to hold temperatures in the 35-F to 42-F range; but the company notes that other ranges can be set and believes many other applications are possible. —ARG



Self-contained alarm is designed to hold temperature in preset range, will also signal faults in thermal system.

To develop a nuclear-powered airplane . . .

the Air Force, Atomic Energy Commission, and the Navy have spent, since 1956, a total of $840.2 million. But as the program is still in design stage—with no target date for construction of a prototype plane to achieve early flight (*PE—July 13, p 21*).

As Vice Adm J. T. Hayward, assistant chief of naval operations for research and development, puts it: the aircraft nuclear propulsion (ANP) program is a "good monument on how not to run an R & D program." His appraisal was given to the joint congressional committee on atomic energy which conducted the first public hearing ever held on the ANP program. The hearing put on the record the basic disagreement which marks the ANP program:

- The Defense Dept, reflecting a traditional scientific approach—as opposed to the engineering view—has ruled against construction of a prototype plane until perfection of a higher-performance aircraft reactor. It has decided that performance of the present design falls far short of conventionally powered aircraft and that the present low-performance design, which could theoretically fly a prototype plane, does not possess any "growth potential."
- ANP engineers in the Air Force and AEC have unsuccessfully argued that early flight of a prototype plane, even with the limited performance offered by present designs, is a necessary first step toward development of an operational weapon system.

Backing Air Force and AEC arguments . . .

for going ahead with a prototype plane to achieve early flight were Democratic majority members of the joint committee. Said Sen Clinton Anderson of New Mexico: "How are you ever going to demonstrate what you don't test? What plane ever designed had perfect performance the first time out?"

Anderson pointed out that priority was placed on construction of a prototype reactor for the Nautilus nuclear submarine even though design of the vessel had not been perfected.

Dr Herbert York, Defense Dept's director of research and engineering, said the Nautilus project was not comparable to ANP. He explained the Administration's refusal to build an aircraft reactor this way:

The first nuclear submarine reactor used a design which "performed substantially better than chemically fueled submarines at the time." An aircraft reactor, using present materials, would not produce a "militarily useful flight."

The controversy boils down to this: While top Air Force and AEC officials want to build a prototype nuclear plane to fly as soon as possible, such a measure could be undertaken only at the expense of other costly weapons-development projects, and the Pentagon's R & D program does not enjoy unlimited budget resources to try all projects.

Crux of the issue . . .

is that the nuclear plane rates lower priority because the Administration's scientific brass is disenchanted with ANP's potential.

As a result, the Pentagon plans to (1) continue development of "only such reactors and powerplants as would be suitable for militarily useful nuclear flights"; (2) speed up work on Pratt & Whitney's indirect-cycle program to determine its potentiality more quickly; and (3) hold back on a hard-and-fast flight objective until an advanced powerplant is established as "feasible and potentially useful" and until a flight program can be started without "seriously interfering with development of militarily useful powerplants."

P&W is one of the two contractors on the ANP propulsion system. The other is GE which is working on a direct-cycle reactor providing direct heat to a turbojet engine, as distinguished from the indirect cycle, which transfers heat through a liquid metal.

In his testimony, Adm Hayward said the Navy considers the indirect-cycle engine more applicable for Navy nuclear seaplane missions (Navy has recently awarded the Martin Co a $127,000 R & D contract to study airframe designs for an A-powered anti-submarine-warfare seaplane which will be equipped with turboprop engines). The admiral said: "We don't believe in a direct air cycle. It has the divided shield instead of the unit shield and exposes all of our equipment to radiation."

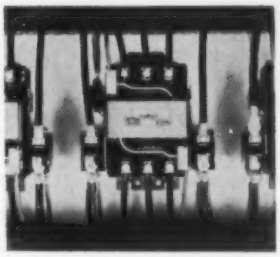
Maj Gen D. J. Keirn, the ANP project boss, hinted that significant developments have been made in reducing the weight of the crucial shielding system. He said crytically that the shielding weight in present ANP designs "does not represent the weight of the chemical fuel" carried by a long-range bomber on a normal mission.

CIRCLE NO. 11 READER SERVICE CARD →

NEW General Electric Size 2 Magnetic Starter WILL FIT INTO THIS SPACE

Save 34% on panel space; get all the fast installation features of G.E.'s 100-Line

You see here the actual amount of panel space which is occupied by a new General Electric Size 2 Magnetic Starter in the 100-Line design. Here are just a few of the benefits you can expect from the new design:



SAVE PANEL SPACE—General Electric Size 2 starter features front-accessible wiring, coil, contacts and overload relays, eliminating the "extra" panel space often required for these operations. Lower coil watts give less heat, and coil inrush current has been reduced so you can use a 33% smaller control transformer.

SAVE ASSEMBLY TIME—This 55% lighter-weight starter is fast and simple to install. Straight-through wiring eliminates run-around wiring that takes extra time and space. To mount, just slide the keyholes over three mounting screws on the panel. You'll easily save assembly time.

GREATER DEPENDABILITY—Exclusive General Electric wedge-action contacts provide positive "make." Less armature mass and spring-loaded contacts practically eliminate contact bounce, provide longer contact life. A new arc trap design attracts arcs away from contacts and dissipates both arc and ionized gases.

EASY MAINTENANCE—Like the rest of General Electric's 100-Line magnetic starters, the Size 2 can be disassembled in 20 seconds, and contacts can be visually inspected in ten seconds. Your customers get simplified maintenance.

LIKE MORE INFORMATION? Contact your nearby General Electric Apparatus Sales Office, or write Sect. 731-16, General Electric, Schenectady 5, N.Y.

GENERAL ELECTRIC

WHAT'S HAPPENING IN... Science

Needed: Barriers that will break

Materials that will protect other structures, even though they themselves are destroyed in the process, are assuming importance in atomic energy as they already have in high-temperature operations. Many fire-retardant and heat-sink materials, for instance, undergo irreversible and destructive changes as they take up heat. But, in so doing, they serve as a protective barrier for a limited time at least (*PE*—Aug 3, p 38).

In the atomic program, the current emphasis is on energy-absorbent materials to protect reactor structures against blast damage should an explosion occur. Here, porous materials with controllable crush resistance—materials that will absorb energy as they are themselves broken up—look especially promising.

Right now, the AEC is thinking in terms of layered porous structures in "sandwiches," with steel plates as facing. Materials of graded crushing strength would be placed between the steel plates with those of lower crushing strength towards the outer side (away from the blast) where less efficient energy absorbers are needed.

Experience thus far, in developing shields for such units as the Experimental Boiling Water Reactor, indicates three major points to be considered. These, as summarized by General Nuclear Engineering Corp in its latest report to the AEC on power-reactor technology, are:

1. In a sandwich structure a maximum attenuation of short shocks is obtained by using the greatest possible impedance mismatch. In practice, this implies the choice of a porous medium which has as low a density and shock velocity as is consistent with other aspects of design.

2. Maximum energy absorption results from the lowest possible "coefficient of restitution" or the largest difference between the stress-strain curve in compression and recovery.

3. Pressure "overshoot" is minimized by using materials whose stress-strain curves are convex upward. Continuous media with such characteristics are relatively rare (two notable exceptions: ice and mild steel). But they are common in porous materials.

Research now needs emptier vacuums

Much present research on surface effects may turn out to be of little value, says Maj Gen J W Sessums, Jr of the Air Research & Development Command. The reason: A great deal of it involves high-vacuum studies, and the best vacuums produced by standard techniques (10^{-6} to 10^{-7} mm Hg) are far from pure. It may even be dangerous, he says, to apply information gained from such research to critical design problems.

In studies of metal surfaces coated with monatomic layers of radioactive tracers, standard vacuums permitted deposit of enough foreign material in 20 min. to coat the surface and prevent the escape of tracer atoms.

When special systems, maintaining 10^{-10} mm Hg were built, the improvement was startling. Coating was reduced by about a thousandfold.

But, he says, "such high vacuums have been achieved only in small-scale equipment so far."

Until bigger and better equipment is developed, and its use becomes general, research results had best be suspect—at least so far as outer-space craft are concerned.

Gas as Supersolvent?

Gases at temperatures so high they cannot be turned into liquids, regardless of the pressure applied, may someday provide a new type of solvent whose activity could be modified by temperature and pressure.

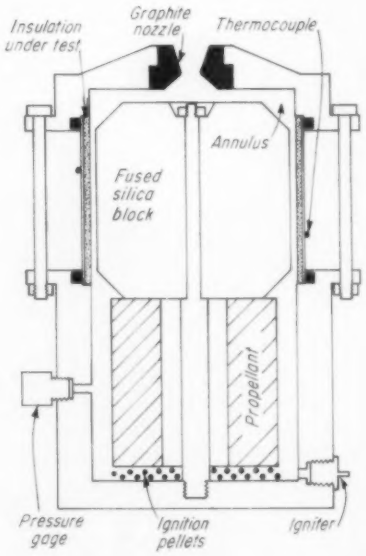
Research at Goettingen University, Germany, indicates it should be possible to produce and use such "supercritical" gases on an industrial scale.

Pressures and temperatures need not be excessive. For example, at 1400 F and 2000 atmospheres, superheated steam can almost completely dissociate dissolved substances. —ARG

Big blast on a small scale

A rocket motor simulator that does almost everything a real rocket would do, without the expenditure of a full-scale charge, has been developed at Naval Ordnance Laboratory. Its aim: to test structural and insulating materials under high temperature and pressure conditions. Its construction is diagrammed at right. Thickness and hole dia of the silica ring determine the mass rate of flow of hot propellant gases past the test material and are chosen to duplicate conditions in a full-scale rocket.

One result so far: a new way to prevent deformation of rocket motor walls.



New testing device consists of a vessel containing igniter and propellant, and supporting a solid cylinder of fused silica. Test section is same dia as an actual rocket motor.

WHAT'S HAPPENING IN...

Materials

After '65, what?

The annual survey of trends and requirements prepared by Aerospace Industries Association contains a good many interesting forecasts of aircraft and missile needs (*PE—July 27, p 23*); but none more interesting than its projections of materials performance, particularly in regard to high-temperature service.

If AIA's goals are met on schedule, it will open the way for vastly improved performance of many nonmilitary products already on the drawing boards.

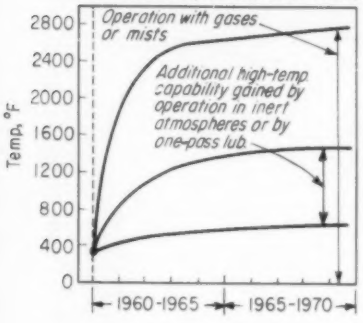
For a number of materials, plastics for instance, the projection is for steadily rising service temperatures over the 1960-1970 period. But, for elastomers, lubricants, ceramics, and refractory metals, the picture is quite different.

For the first two, the big hump in the demand curve comes almost immediately. Elastomers now able to stand 700 F on a continuous basis for 30 min. at least, will have to reach 4000 F by 1965; but the 1970 goal should be easy from that point. It's "only" 5000 F. On a short-term basis (30 sec), those now able to stand 4000 F will have to go to 9000 by 1965, 10,000 F by 1970.

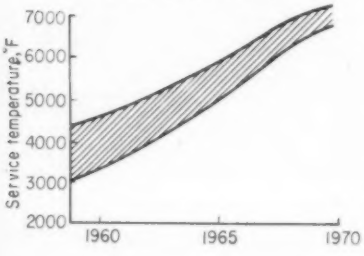
For stainless and superalloys, on the other hand, the picture is just the reverse. Relatively little improvement is expected in the 1960-65 period; but a king-size leap will be needed between 1965 and 1970. Superalloys now able to stand about 1500 F, for instance, will be expected to take only about 1650 F by 1965. But they'll have to get to 2250 F by 1970 to reach AIA's goals.

Copies of the complete report, showing best current and projected performance for the major classes of materials, are being made available to "government agencies and industries serving the aerospace complex" by AIA, 7660 Beverly Boulevard, Los Angeles 36, Calif.

RANGE OF LUBRICATION WITH LIQUIDS, GASES AND MISTS



MAXIMUM OPERATING SPECTRUM: CERAMICS AND CERMETS



Gold in your product's future

The same qualities that made gold the jeweler's delight are bringing it increasing recognition as an industrial material: corrosion resistance, malleability, reflectivity. Cost, of course, is a problem—but not so much in these days of high-cost exotic metals and high-level, extreme requirements. Too, new application techniques are available to help keep over-all product costs down.

Today, gold is being used to line nuclear reactors (*PE—May 4 '59, p 10*) and to coat electrical contacts, terminals, and switches. It's going into infrared detectors and optical equipment and finding a variety of jobs in the missile field.

For instance, using new vacuum techniques, controlled-thickness gold coatings can be deposited that will reflect some light rays and transmit others. One possible application: windshield coatings that will screen out infrared, conduct electricity for defrosting, yet not impair visibility.

In rockets, the high heat reflectivity of gold is bringing it an important job. National Research Corp reports that vacuum-deposited gold coatings on missile surfaces exposed to the intense heat of the exhaust during takeoff provide substantial protection for these surfaces by virtue of their high heat reflectivity. And, NRC says, the amount of gold required to do the job is so small that "materials costs are negligible."

Even the thicker, plated coatings can be relatively inexpensive. Englehard Industries claims its Atomex immersion process (*PE—Sep 9 '57, p 5*) produces a layer so dense and uniform that total amount of gold used can be held to a minimum. EverLube Corp, too, has an immersion process which, it says, provides a dense, uniform coat even on complex parts.

briefs . . .

Gallium, in high-purity form, is being made available by Aceto Chemical Co, Flushing 54, NY. Looking toward semiconductor applications, in transistors, rectifiers and other electronic equipment; metallurgical uses (alloying with aluminum, magnesium, silicon, iron); and possible nuclear heat exchange applications, the company says it is ready to supply the metal in both 99.99% and 99.999% purity. At this level, the metal has a melting point of 85.55 F and a boiling point above 3600 F and is not attacked by mineral acids or by boiling water.

Antistatic finishes—more than three score of them—are listed by Chemstrand Corp in a bulletin prepared last year but only now being generally released. While the listing is specifically directed toward application to the company's Acrilan fiber, it provides a good rundown of types, trade names, and manufactures; is particularly valuable in that it separates temporary from permanent (wash-resistant) compounds. —ARG

Foils must be light—they must be steel There was a time when your very life depended upon

and tough enough to spring back unharmed after countering the intended death blow. These characteristics have

STEELS FOR DESIGN

your blade. It had to be as light as human ingenuity could make it. But it also had to be strong,

made steel the most important metal in the history of man. For some modern, lightweight examples, turn the page ▷ ▷ ▷

CHAPMAN TRANSPORT INC.

STEELS FOR DESIGN

Stainless Steel builds a stronger, lighter trailer. This 40-foot trailer is one of the latest models designed and built by the Fruehauf Trailer Company. It's the strongest, lightest trailer in its class because it was built with Stainless Steel. The Stainless has a yield point of 120,000 psi, almost four times greater than competitive materials, so the walls, roof, and braces could be made thin and very light, yet they are rigid and strong. The exceptional corrosion resistance of Stainless Steel practically eliminates maintenance. This trailer will never have to be painted or refinished and it will still look clean and new after many thousands of miles.

High Strength Steel cuts cable reel weight 25%. The George Evans Corporation is the largest manufacturer of cable reels in the United States. Each of these reels has to carry and protect about $5000 worth of cable—seven tons of it. The reel must be strong and rugged or it will buckle under its load as it bumps over rocks and timbers in the field. It must *also* be exceptionally light, or freight costs will be exorbitant and field handling almost impossible. For a long time, these reels were made of wood and they lasted about two years. Then, the company started to make an all-steel reel, with the rims made of USS COR-TEN High-Strength Low-Alloy Steel. The COR-TEN Steel reels are much stronger and they weigh 25% less than wooden reels. They *cost less*, too, because they cut freight charges; they practically eliminate maintenance; and they will last about twenty years.

USS "T-1" Alloy Steel cuts tanker weight, increases payload. Trinity Steel Company of Dallas, Texas, makes LPG transport tankers and recently the company tripled production to meet the demand for its new, lightweight models. Trinity increased the payload of these tankers substantially by cutting the weight of the carrier itself as much as one-third. They used USS "T-1" Constructional Alloy Steel. Because "T-1" Steel is extremely strong—100,000 psi minimum yield strength—the tank walls are made about ⅓ thinner—with a comparable reduction in weight. And the weldability of "T-1" Steel meets the rigid ASME code that requires X-Ray and magnetic particle inspection of all joints.

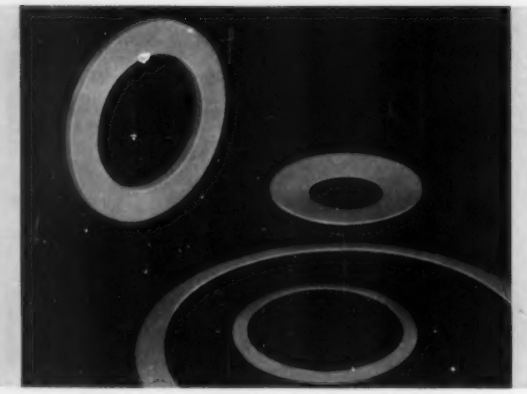
USS, "T-1" and COR-TEN are registered trademarks

United States Steel USS

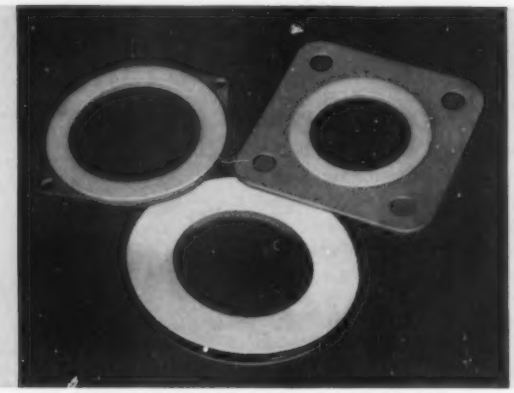
GARLOCK

Teflon* Gaskets

A DESIGN FOR EVERY JOB INVOLVING CORROSIVES, EXTREME TEMPERATURES

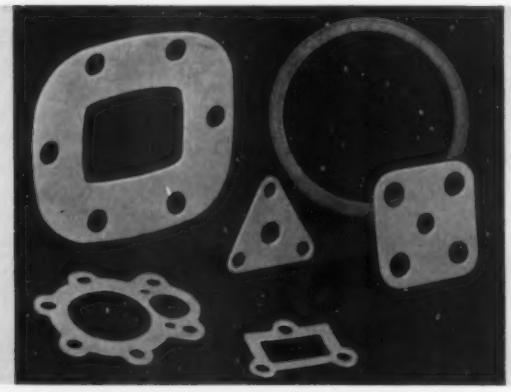


SOLID TEFLON GASKETS remain chemically-inert, tough, non-adhesive at temperatures from −110°F to +500°F. Furnished in ring or full face sizes for all standard pipe diameters from 1" to 12". Will withstand pressures up to 300 psi.



TEFLON-JACKETED GASKETS offer the advantage of using Teflon without sacrificing resiliency and deformability. Applied widely to glass-lined process equipment, light metal flanges, glass pipe flanges and fittings. Fillers are available in all types of gasketing materials.

SPIRAL WOUND METAL-TEFLON GASKETS will maintain tight joints where temperatures cause expansion or contraction of equipment. Used against acids, chemicals. Recommended for tube plates, manholes, handholes, flanges.



SPECIAL TEFLON GASKETS of all shapes can be furnished to your drawing or template. Also, Teflon-Treated Blue Asbestos Gasketing is ideal where a less expensive, yet strong, compressible seal is needed to resist acids.

Teflon gasketing is another part of "the Garlock 2,000" . . . two thousand different styles of packings, gaskets, and seals. Get more details from your Garlock representative, or write for Catalog AD-154.

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CIRCLE NO. 18 READER SERVICE CARD

Product Engineering HORIZONS

August 10, 1959

THE TALE OF MELVIN . . .

his poise disturbed the gulls

Once upon a time, there was a seagull named Melvin. He lived on the Georgia seacoast—a rather fat life on refuse from the shrimp boats. He and the other gulls didn't have a care in the world.

But Melvin was different. He once had picked up and lugged home a sign that had fallen from a passing yacht. The sign read: THINK. So Melvin became a thinker. That's what made him different—and even his friends noticed it. They, who had never heard of Rodin, got to calling Melvin "the THINKER", but they tended to mispronounce the second word. And they also tended to let Melvin alone, so he had extra time to think.

Melvin did a little delving into seagull history, and found out that gulls had had to work for their living once by actually catching fish in the sea and by digging clams which they hauled up in the air and dropped on rocks.

Melvin was pretty impressed by the wisdom of the legendary gull who figured out the clam-dropping routine. He tried it, and it worked, but the other seagulls thought he was queerer than ever.

Melvin also noticed another thing: The seagulls in general were growing skinnier. There wasn't as much shrimp offal around all of a sudden. He thought about this too—which cut down on his own scavenging almost to the danger point—and came up with an interesting statistic: the number of shrimp boats around was dropping fast.

A little listening from mastheads and piles confirmed his observations. More and more shrimp boats were pulling out for some place called "the Gulf," where more and bigger shrimps were reported.

So Melvin started to pass the word among the gulls. But they thought he was gulling them. Pooh, pooh, pooh! Who'd ever heard of shrimp boats leaving? Even their grandpas had lived off the fat of the shrimp fleets. And if they started for the Gulf, how would they live? Digging clams? Ugh! Catching fish? That sounded like work.

But Melvin was still disquieted. He went home and looked at his THINK sign again. Then he took off down the coast with it under his wing. The going was pretty tough—he had to keep scrounging for fish and clams, and he developed an even slimmer silhouette than he'd had —almost a Coke-bottle shape.

Periodically, he'd see a shrimp boat go by, and that kept him on the beam. He even met some strange seagulls in Florida who had a pretty good living around the dumps back of Miami Beach. But they resented Melvin and his sign too.

At long last, the Gulf. And there were the shrimp boats, and bigger and better shrimp offal. So Melvin hung up his sign and settled into the good life. He even sent a message by a passing tern inviting his relatives. But next migration season the tern reported the Georgia coast was littered with dead seagulls, among them Melvin's relatives.

MORAL: Thinking is a lonely business, but it keeps you in shrimps.

R. Haugeman

No hiding place for underseas prowlers

Raytheon sonar is as far-reaching as the sea itself. From the air, the surface and the depths, underwater vision is eliminating the hiding places of underseas prowlers. Development of sonars for the highly diversified vehicles and environments necessary to achieve complete surveillance requires a highly adaptable engineering staff.

PROFESSIONAL ASSOCIATION WITH A FUTURE is open to qualified engineers and scientists with BS or advanced degrees. Positions are available in systems, development, design or manufacturing engineering of a wide range of complex equipments. Please write Donald H. Sweet, Government Equipment Division, Raytheon Company, 624 Worcester Road, Framingham, Massachusetts.

Engineering Laboratories: *Wayland, Maynard, Sudbury, Mass.; Santa Barbara, Calif.*
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Excellence in Electronics

GOVERNMENT EQUIPMENT DIVISION

LAND SEA AEROSPACE

V-6 Engines Take Over Job of Driving GM Trucks

Big manufacturer's designers cite many advantages over the V-8; pioneering new series includes three V-6's and a doubled-up version—V-12.

PONTIAC, MICH—The V-6 engine is now going into American trucks for the first time. It is making its debut in a new series of truck engines developed by the Truck and Coach Div of General Motors; the four basic units offered will blanket all power needs for GM's truck line. With advent of the V-6's the company will virtually end production of its V-8's.

Of the four new engines, three are V-6 models with 305, 351 and 401-cu in. displacement. The other is a V-12 model with 702-cu in. displacement and is essentially two 351 engine blocks cast together. Only minor design changes were required to combine the two units. This powerful V-12 is expected to give trucks a passenger-car speed on hills.

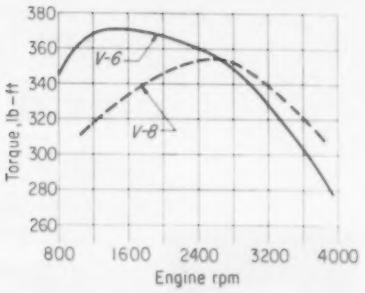
GM asserts several advantages for this series of engines over the straight-six and V-8 designs. One obvious asset is compactness—the two banks of cylinders lie at 60° angles to one another, an arrangement that nevertheless leaves sufficient room for effective cooling and easy maintenance. Valves, as an example, are placed so that they can be more effectively cooled than in the flat six and their tappets can be removed through an opening in the cylinder head without removing the head. As compared with the V-8's, the new engines are simpler in design, have less internal friction and operate more efficiently.

LESS INTERNAL FRICTION

In the new series, short piston strokes reduce internal friction between cylinder walls and pistons. Stroke for all engines is 3.58 cu in. The 305 has a 4.25-in. bore; the 351, a 4.56-in. bore; the 401, a 4.88-in. bore.

Considerable engineering effort has reportedly been put into controlling temperature at critical points in the engines. For fast warmup, the intake manifold is preheated by pulsing exhaust gas from one head to another through a passage along the bottom of the manifold.

Life expectancy of valves and seats has been extended by more effective heat removal. This is obtained by circulating 120 to 200 gpm of water (double the flow to the radiator) through the cylinder heads. Water flow through the cylinder heads is always rapid, even when thermostats are closed. A special bypass facilitates flow through the engine.



Maximum torque . . . .
at low engine speed is characteristic of GM's V-6 and V-12 engines. The 401, for example, develops peak torque at 1400 rpm compared with 2500 rpm for a typical V-8. Unofficial ratings for the units are said to run 150 hp at 3600 rpm for two models of the 305, and 165 hp at 3800 rpm for a third model; 180 hp at 3400 rpm for the 351; 205 hp at 3600 rpm for the 401; and 275 hp at 2400 rpm for the fast-hill-climbing 702.

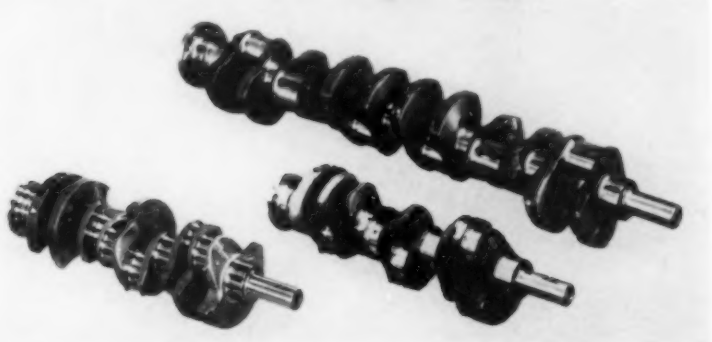
The new engines are designed to give maximum torque at low engine speeds. The 401 develops maximum torque of about 1400 rpm; an equivalent V-8 requires 2500 rpm. In the V-12 model, large displacement (702-cu in. total) allows operation at low specific horsepower, which is accompanied by high torque at reduced throttle openings. The result is increased valve life and reduced fuel consumption.

Finally, these engines work well with 5-speed as well as 10-speed transmissions. In the simplified design that thereby becomes possible, a single-speed axle replaces the normal double-speed axle of most trucks.

EVOLUTION IN MATERIALS

Choice of materials for the motor reflects evolutionary rather than revolutionary trends. The engine blocks and heads are still made of cast iron, but it is a fine-grain chromium-nickel alloy. Engine blocks derive additional strength from a 3-in. skirt at bottom of the block. Pistons are of cast aluminum made by the permanent-mold process.

Crankshaft for the 305 is cast Armasteel; for the other models, forged chrome-alloy steel. Ruggedness of the new engines compared with their



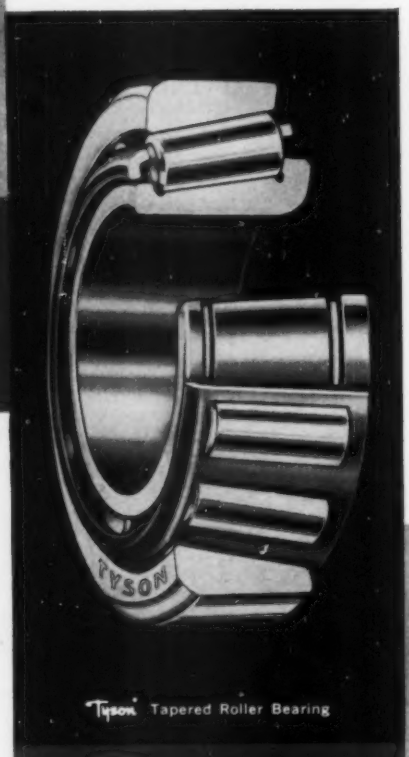
Forged crankshaft . . .
at center is designed for both the 351 and 401 V-6 engines; one at top is for the V-12. The cast Armasteel shaft at left has machined dimensions identical with the others, will be used in the 305 engine. Individual crankpins are provided for each piston—possible because right and left banks of cylinders are staggered.

We make so many sizes . . . your "specials" could be our "standards"

Angular Contact Bearing

Spherical Roller Bearing

Spherical Roller Thrust Bearing



Tyson Tapered Roller Bearing

Cylindrical Roller Bearing

Single-Row Deep Groove Bearing

We regularly produce all of the bearings shown here in a tremendous variety of bores, outside diameters, and widths.

Take just the Tyson tapered roller bearing, for example. We make nearly 1,000 sizes of the single-row, straight bore type alone! Bore sizes range from five-eighths of an inch right up to a precise fourteen inches. And these figures don't include the many other sizes available in our double- and four-row types.

Yet they are all standard SKF *bearings,* promptly available in large quantities at competitive prices.

So, why not get full details on the most complete line in the business? Any of our twenty-five sales offices can quote you facts and figures. Just call the one near you.

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Spherical, Cylindrical, Ball, and Tyson *Tapered Roller Bearings*

EVERY TYPE—EVERY USE

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THESE PARTS ARE INTERCHANGEABLE . . .

between V-6 and V-12 Engines:

Connecting-rod assembly
Main and connecting-rod bearings
Water-thermostat assembly
Oil-pump drive shaft
Oil-pump relief-valve assembly
Crankshaft rear oil-seal
Crankshaft front oil-seal
Exhaust-manifold gasket
Front cover to cylinder-block gasket
Rocker-arm assembly
Pushrod
Rocker-arm shaft brackets
Spark plug
Valve springs
Valve-spring retainer
Valve-spring retainer key
Rocker-arm cover
Rocker-arm cover gasket
Valve tappet cover
Valve-tappet cover gasket
Intake-manifold gasket
Camshaft thrust plate
Fuel-pump eccentric
Ignition-distributor gear
Tachometer adapter

and on V-6 Engines:

Camshaft
Camshaft bushings
Tappets
Rocker-arm shaft
Oil-pan gasket
Oil-pump body
Ignition coil
Ignition-coil bracket
Ignition coil to distributor high-tension cable
Spark-plug cable assembly

V-8 predecessors is illustrated by the fact that new crankshafts of the 401 weigh 110 lb; the old V-8s, 63 lb.

INTERCHANGEABILITY

From the manufacturing viewpoint, a single feature of the new engines is the enormous number of interchangeable parts. Many are interchangeable between all four models (see box).

In addition, crankshafts on the 305 and 401 are identical though of different materials. And the same cylinder-head assembly and gaskets serve the 351, 401 and V-12 engines. The cylinder head includes valves, valve springs, rotators, rocker-arm brackets and shafts and rocker-arm covers.

All V-6 models except one variation of the 305 use the same 8-qt oil pan; and all models except one variation of the 305 use the same 2-qt oil filter and housing. The 351, 401 and V-12 engines are designed for identical exhaust manifolds.

The new engines need three designs for front-end covers that house water pumps. One design is for the 305; the other two are interchangeable on all other engine models. ■

Tunnel Diode Joins Electronics Family

SCHENECTADY—Another challenger to transistors approaches commercialization with the announcement by General Electric Co that it plans to make tunnel diodes available for evaluation. Developed in Japan, the device is similar to a transistor but operates on a somewhat different principle—rapid channeling of the charge in a diode as compared to relatively slower movement in a transistor.

According to GE's Research Laboratories here, the new device will operate 10 to 100 times as fast as a transistor, and should be able to handle much higher frequencies. It operates at higher temperatures—650 F for a

Tunnel diode . . . .
can simultaneously perform, according to GE, the following functions necessary in an FM receiver: amplification, oscillation, conversion, limiting, detection, and automatic frequency control. If an FM receiver were rebuilt using a tunnel diode (shown in inset) all of the other conventional components pictured (at left) could be omitted, although with some sacrifices in performance. Such performance limitations reflect the present state of the art and not the inherent capabilities of the tunnel diode.

silicon tunnel diode as compared to 400 F for its transistor counterpart—and with a lower noise level.

The tunnel diode is said to be impervious to nuclear radiation, suggesting its use in radiation-bombarded space vehicles and instruments positioned near nuclear reactors.

It can be made of germanium, silicon or other semiconductors and may be used as amplifier, switch and high frequency rf generator. The tunnel diode has a very low voltage output but GE engineers believe this may be an advantage because power requirements are lower than for the transistor.

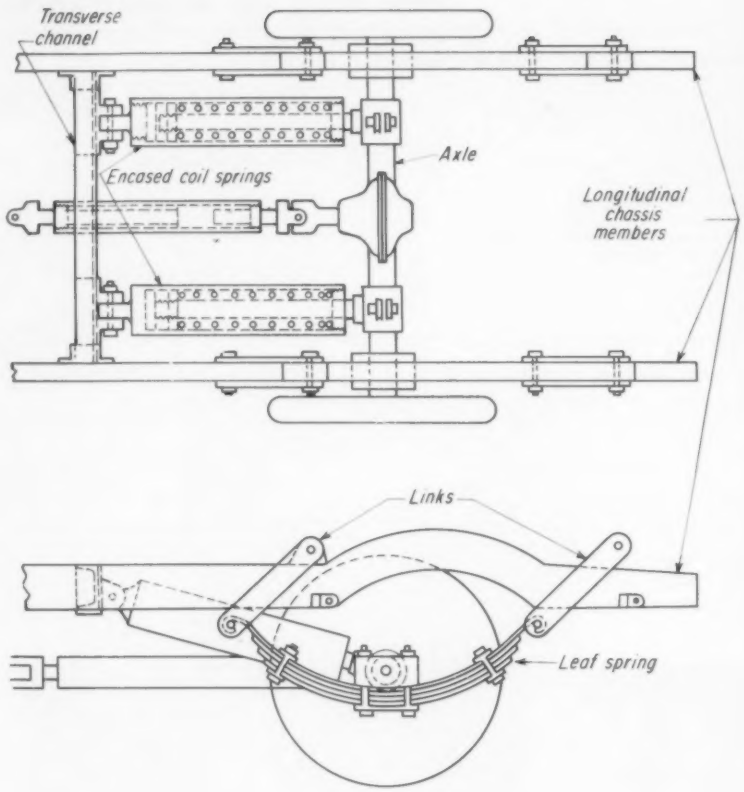
What differentiates tunnel diode from transistor is the time it takes the charge carrier after leaving the emitter to traverse the control region and appear on the collector. In a transistor the time is long compared to that in a tunnel diode, in which the carrier moves with the speed of light.

GE engineers don't say that the tunnel diode will replace the transistor completely; rather, it can supplement the transistor in circuit design. According to one GE engineer, it will improve the worth of other components and perhaps permit design of equipment now considered impossible or impractical to develop. For example: designing truly portable FM-radio-TV sets. ■

Germans Boost R & D Allotments

BONN—Grants for research by the German Federal Government have more than quintupled since 1955. In that year the government put up $24 million for scientific and technical quests; this year they will put up $135.7 million. This means that total research expenses of the Federal and State governments will amount to $430 million this year. In addition, industry has made grants of $12 million to public research organizations.

Considering that companies will spend at least $190 million on their own industrial research, total West German R & D will amount to $632 million this year or 1.1% of gross national product—the nation's aggregate output of goods and services. ■



Chinese Inventor Converts Car Momentum into Fast-braking Power

HONG KONG—Normal braking distance is cut by 80% when his new braking device is used, according to inventor F. T. Chen, refugee Chinese physics professor. Chen says his device also decreases danger of car turnover or skid, and increases passenger safety by absorbing the ordinary forward momentum resulting from braking suddenly at high speeds.

Several arrangements of components, and types of components can be used. One system (see sketch) secures a transverse channel to the chassis forward of the rear axle. Encased coil springs are pivoted at the channel and connected to the rear axle. Leaf springs carry the axle and wheels, but the springs are pivoted to links rather than chassis-mounted. Links project forward and downward.

Upon braking, part of the forward momentum is consumed in lifting the rear end of the car, and part in compressing the coil springs. Lift produces thrust on the leaf springs with a corresponding increase in friction between the wheels and road surface. In addition, the lift imparts a pressure to the front wheels and, in turn, a reaction pressure to the rear wheels. Over-all result: A 40-mph car has been braked to a stop in 16 ft.

The vehicle's lifting, after braking, causes an upward diagonal resultant force on the passengers instead of a normal downward diagonal force. Cushioning and passenger weight act against the resultant force further to increase safety of the individual passenger.

Chen claims the device can be installed on old as well as new cars, that it weighs a maximum of 100 lb and can be mass produced for $50. Braking arrangement can be used on other vehicles besides cars; for example, it can be used on trains. ■

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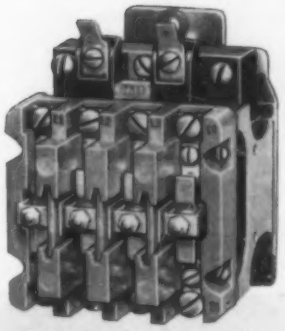
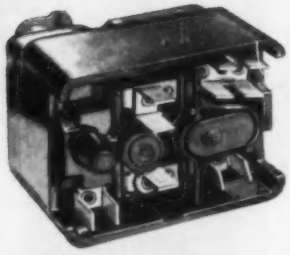
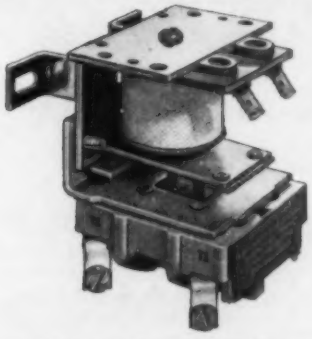


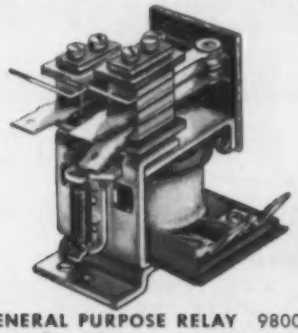
TYPE C—30, 40, 50 AMP. 2-3-4 pole 30 amp.—600 volts. 2-3-4 pole 40 amp.—230 volts. 2 pole 50 amp.—230 volts. Same mounting holes and coils for all ratings and pole forms.



SERIES 128000 POTENTIAL STARTING RELAYS For starting single phase capacitor start compressors.



TYPE 80 CONTROLLER Specific design for nominal 3 HP or 3-ton single phase compressors.



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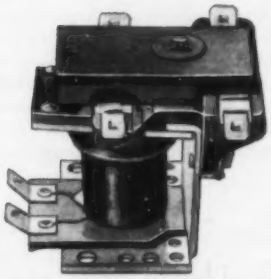
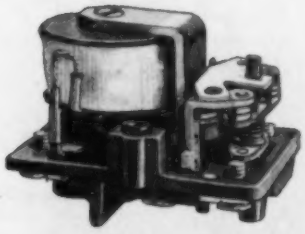
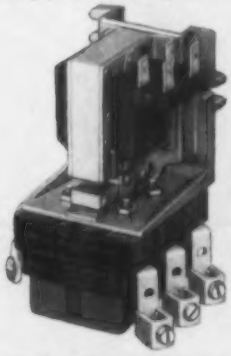


TYPE 75 Low cost power relay. Dependably handles up to 6000 W. at 240 V., resistive load per pole. Compressor rating 2 poles, 18 amp. running, 90 amp. locked rotor at 250 volts.



SERIES 129000 SHUNT TYPE RELAY—SPNO, SPNC or NO-NC For standard commercial voltages. Other coils available for special application. For heater, fan control, general circuit switching, etc.



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80 Equations Predict High Demand for Engineered Goods

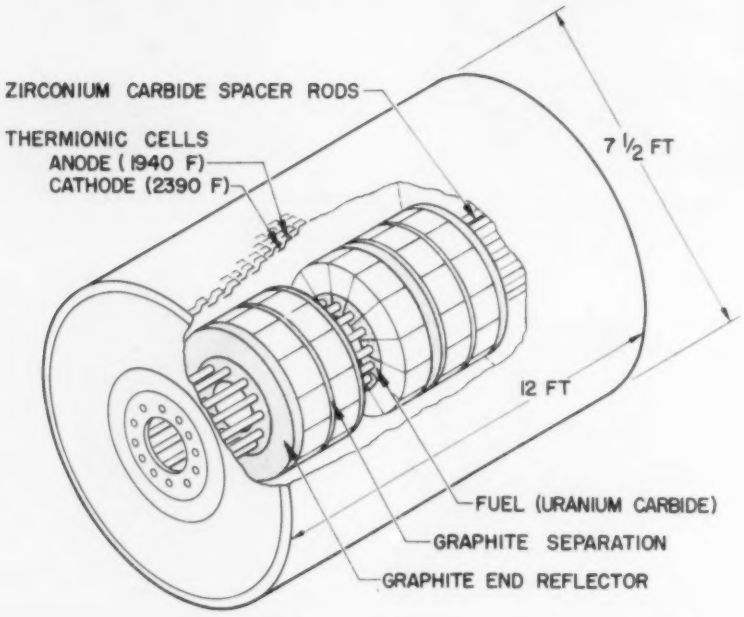
NEW YORK—The next 18 months will be good ones for manufacturers of heavy engineered goods. This is the prediction by the Econometric Institute, a New York economic forecasting concern.

It bases predictions of short-term economic fluctuations on a mathematical model of the economy. This model consists of 80 equations that describe key economic relationships. They are solved simultaneously on an IBM 650 to produce quarterly forecasts of US economic status.

The remaining months of the current boom, the Institute says, will particularly favor the capital goods industries—a group that up to now has lagged in recovery from the 1957 recession. The Institute predicts an especially rapid rise in production of machine tools, because industry is generally reaching the limits of productive capacity and needs new equipment to keep pace with demand. Production of all types of non-electric machinery next year is expected to rise 23% above this year. Output of such consumer durables as appliances is rising, but not expected to reach the peaks of 1955-56. The Institute also forecasts 6 million passenger cars this year and 6.5 million in 1960.

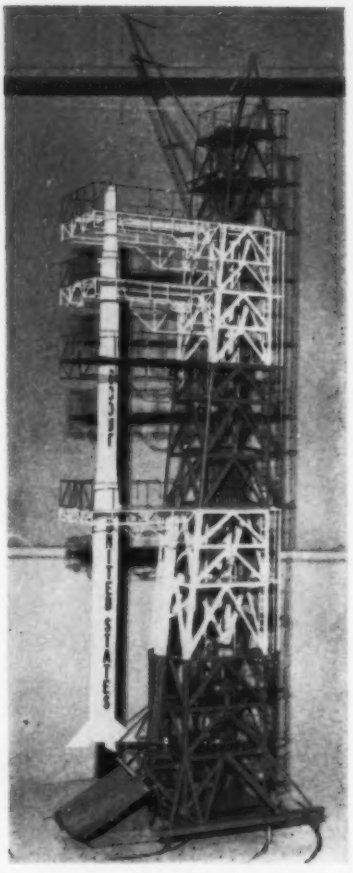
A high level of economic activity is foreseen through next year. This boom, the Institute says, will be followed by a recession in two or three years. But Institute economists decline, until September, to pinpoint timing of the expected downturn. ■

Reactor to Help Power Ionic-propelled Spacecraft



Nuclear reactor proposed by Lockheed to convert atomic energy directly into electrical power to run a spacecraft's ionic propulsion system is diagrammed here. Such a system can only be used after the vehicle and reactor are boosted into space by a large chemical rocket—the latter still poses considerable problems. The 2100-C heat from the reactor boils electrons off tiny thermionic cells arrayed around the outer shell of the reactor to produce the required electrical energy. The reactor's 1000-kw yield is sufficient to power an ionic-propelled spacecraft for a year, once it has been boosted into space. To lighten the load and assist takeoff, Lockheed proposes to eliminate shielding by separating the spacecraft from the 3½-ton reactor with a mile-long coaxial cable as protection against radiation.

Low-cost Rocket Developed



This scale model of the Scout research vehicle and launcher, designed and being built by Chance Vought Aircraft, is a 4-stage, solid-fueled rocket-propelled vehicle which can send a 100-lb instrument package 5000 mi or more high, and place a 150-lb payload in a nominal 300-mi orbit. The 70-ft, relatively low-cost vehicle, will be used by NASA for high-altitude probes of space, and reentry research.

Firm Sues Ex-employe for Usurping Data

ALEXANDRIA, VA—Melpar Inc, a manufacturer of military and commercial electronic equipment, has brought suit in US District Court here against two former employes, claiming they set up their own company and proceeded, without permission, to exploit Melpar trade secrets, proprietary data and inventions in the electronic field.

The two ex-employes, Richard Williams and Jonathan Broome, are named

as defendants along with their newly organized company, Scope Inc, of Fairfax, Va. Melpar's plant is located at nearby Falls Church. The plaintiff is seeking an injunction against Scopes and a half million dollars damages.

MIXED-BASED CONCEPT

Involved in the suit are inventions which Melpar claims it developed and which are known in the art as the mixed-based concept—said to have broad applications to many phases of military and commercial electronics. Proprietary data described in the complaint includes inventions, drawings, studies, R & D technology, engineering data, and production technology.

Melpar also charges that its new competitor is trying to hire away substantially all technical employes who are experienced in the mixed-base concept. Twenty Scope employes, formerly with Melpar, are named in the complaint. Melpar says that it formerly employed over half of the present Scope staff. (For details about another lawsuit in the same category, (see *PE*—Aug 18, '58, p 23). ■

Metal-removal Method for Closer Tolerances

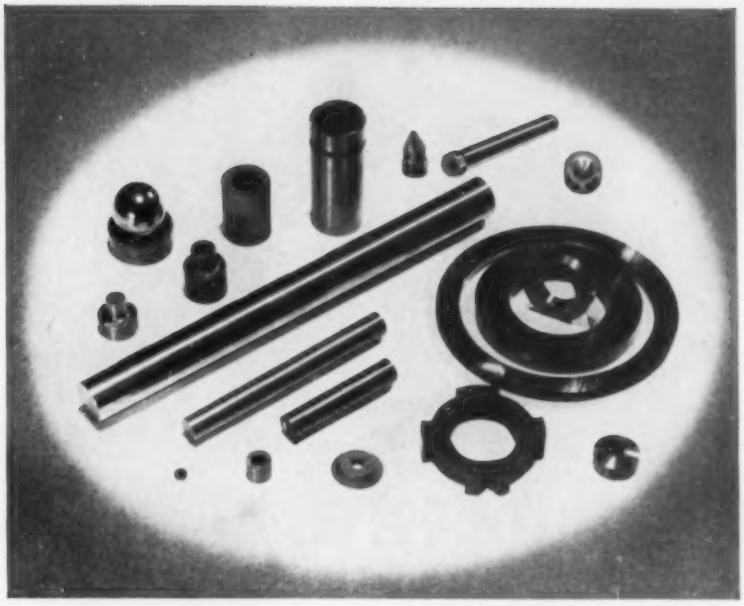
MANHATTAN BEACH, CALIF—A manufacturing method using chemicals to improve tolerance to less than ± 0.001 in. has been reported by US Chemical Milling Corp. Heretofore, missile-makers have been plagued by the unavailability of sheet steel rolled to a sufficiently close tolerance (± 0.003 in. is the closest achieved to date).

USCM officials said the new method, called Chem-Tol, is completely distinct from conventional chemical milling techniques. The latter use maskants and etchants to produce a finished part; Chem-Tol brings sheet stock, or parts of any configuration, into close over-all tolerance. It may be applied at any point in the manufacturing sequence: before or after forming, machining or chemical milling.

SEE USE IN MACH-3

Chem-Tol has special significance for the so-called Mach-3 aircraft, which will require steel skin. While in the F-100, for example, airplane manufacturers could accept the small varia-

(CONTINUED ON PAGE 30)



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Very broad applications have been found for these remarkable characteristics: long-wearing plungers, compressor cylinder liners, seal rings for rotary pumps, bushings, valve parts, high temperature sensor elements and hundreds of other critical component parts are being made from Kennametal.

Pushing design frontiers ahead means forcing back the barriers of wear, pressures and temperatures. As man's imagination continues to develop ideas, new problems are encountered . . . for which Kennametal often has the answer. For example, here's how a pump manufacturer recently used Kennametal: problem—to obtain a large pumping capacity from a small pump . . . without increasing pump size. Solution—use Kennametal for critical operating parts to permit faster pump speeds and higher pressures. A simple answer, but made possible only by the great wear- and corrosion-resistant characteristics of Kennametal.

If you'd like more information, write for Booklet B-111A, "Characteristics of Kennametal." KENNAMETAL INC., Dept. PE, Latrobe, Pennsylvania.

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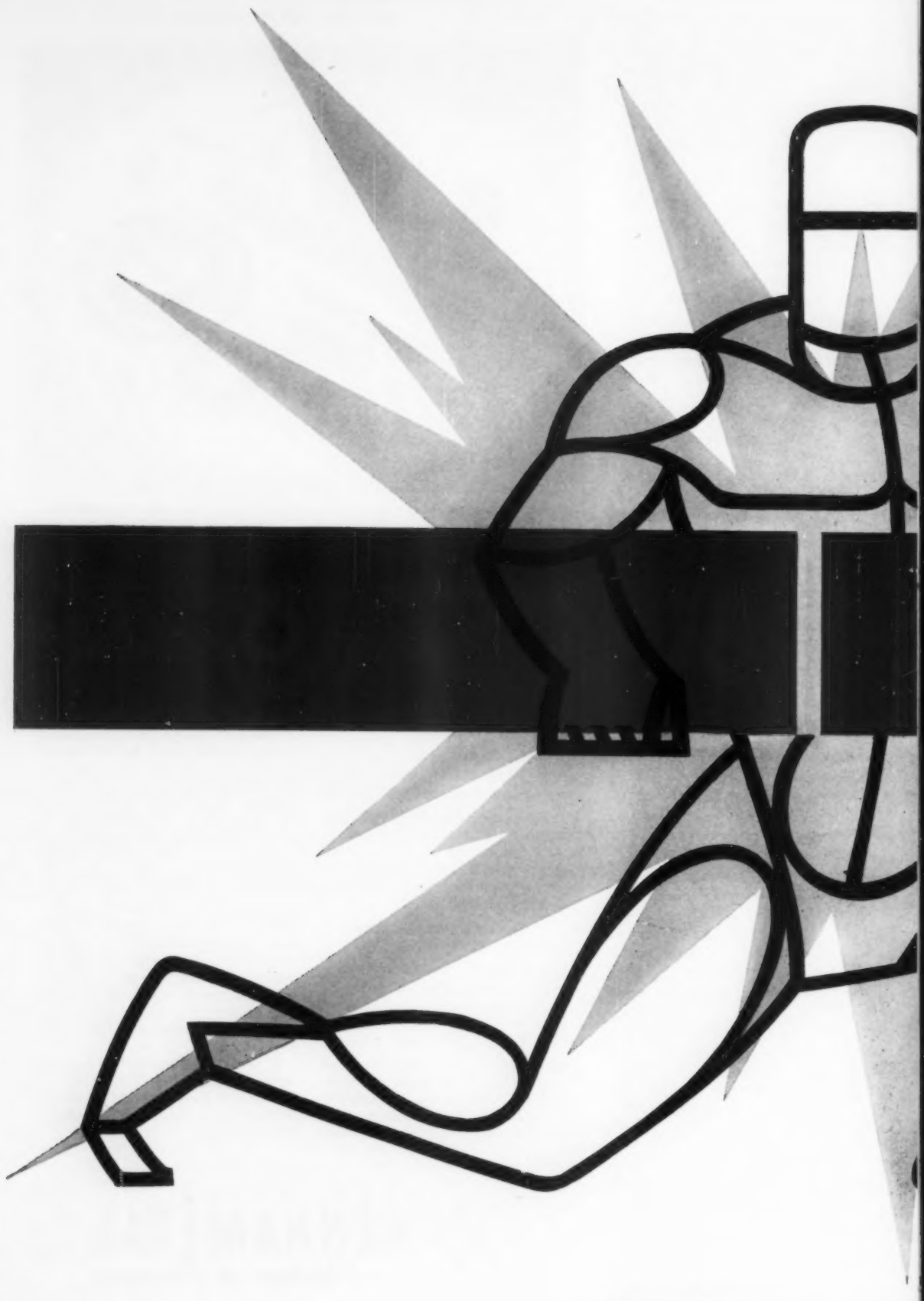

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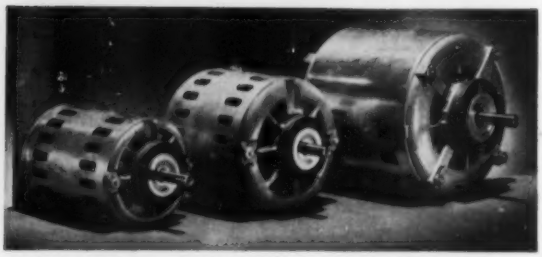

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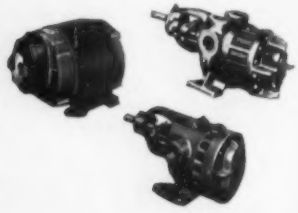

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tion of less than 50 lb that results from available metal tolerance, a 0.0001-in. thickness in a Mach-3 bomber could mean as much as 2000 lb of extra weight.

North American Aviation Corp is evaluating the method, plans to run tests to confirm USCM claims. ■

NBS Wages War on Corrosion

WASHINGTON—The primary processes of corrosion are being investigated by the National Bureau of Standards to give science and industry solutions to some of the practical engineering problems encountered today.

In some of the research, large single metal crystals are used to correlate corrosion with the arrangement of atoms in the crystal lattice. The role played by electrical phenomena and cathodic protection comprise a phase of the program.

One study deals with the nature and mechanism of formation of oxide films on metal surfaces. The effect of illumination on the corrosion reaction has also been studied. By attacking the problem from different directions, the Bureau's corrosion research staff hopes to improve present methods of combating corrosion. ■

US-UK to Cooperate in Space Exploration

WASHINGTON—Proposals for cooperation with the US in scientific research in space, prepared by British scientists after talks with NASA have been approved by the British government, announced Dr Hugh Dryden, deputy administrator of the NASA (*PE*—May 25, p 22). Final approval is subject to the conclusion of formal arrangements between the two governments.

British scientists will prepare instrumentation for satellites to be placed in orbit by the US, he continued. Launchings of the British-instrumented satellites would take place over the next three to four years.

The satellites, Dr Dryden concluded, are to be launched by the Scout, a low-cost rocket vehicle now under development by the NASA. Made up of four stages, it is capable of putting a 150-lb payload into orbit more than 300 mi above the Earth. ■

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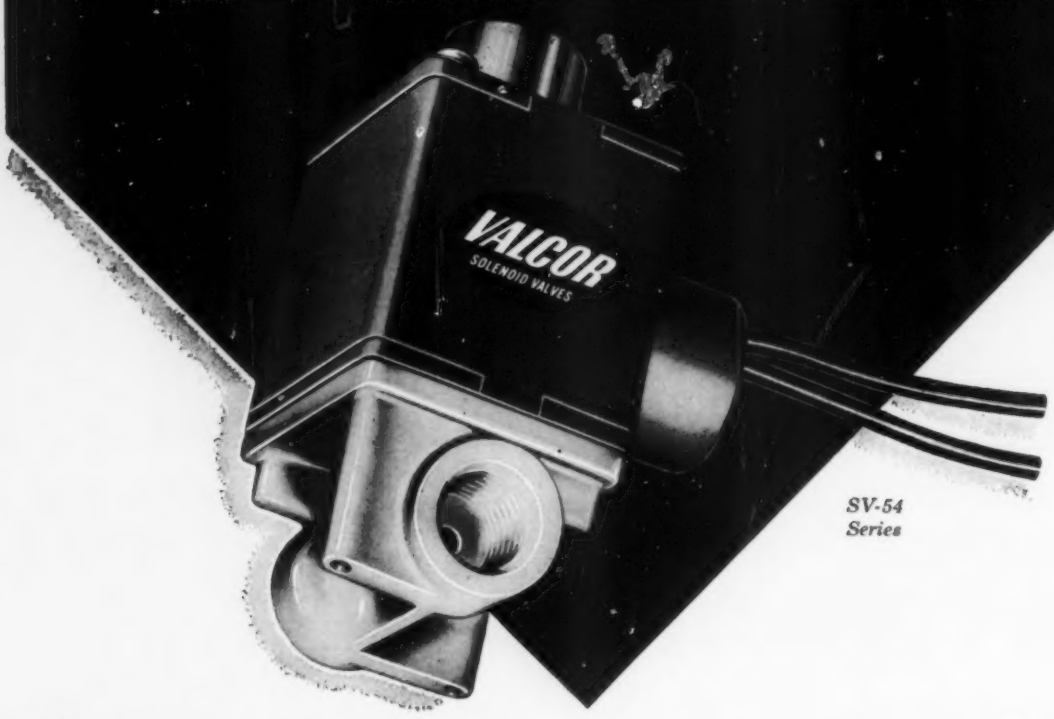


SV-54 Series

VALCOR'S new 3-way Nylon solenoid valve, SV-54 Series, outlasts and outperforms steel, yet is list priced as low as $10.75! In general purpose and O.E.M. installations, where millions of operating cycles are essential, this new Valcor valve not only works best but costs less.

Its nylon seat outlasts steel... its port threads outlast steel... pound for pound it's *3 times stronger than steel.* Dry seal threads, no compound is needed— and they won't loosen even under severe vibration. Nylon is non-corrosive so you have no atmospheric problems. And the stainless plunger is a reliable workhorse for millions of cycles. Bubble tight sealing. Available in normally open, normally closed and "directional control" configurations in all normal AC and DC voltages... 1½" square x 3" long (valve illustrated).

Write today for complete technical data on this shock-resistant, pressure-proof valve— the 3-way nylon-body valve, SV-54 Series, that's 3 times stronger than steel, yet costs less. Try it on your toughest application.

VALCOR SOLENOID VALVES

VALCOR ENGINEERING CORP.

5375 Carnegie Avenue, Kenilworth, New Jersey

save 6 ways

on assembly time

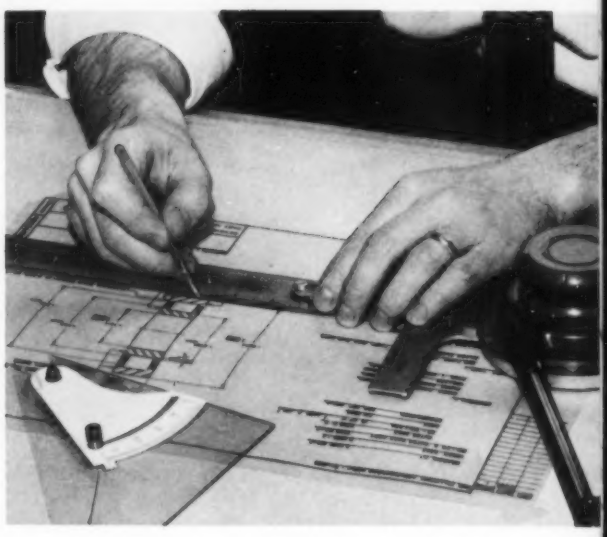
and cost...

HYATT

HY-ROLL BEARINGS

ASSEMBLY AND DIS-ASSEMBLY

when you design around HYATT separable metric series bearings



6 WAYS HYATTS HELP SAVE TIME AND COSTS

1 HEAVY PRESS FITS ELIMINATE RETAINING DEVICES. HYATT inner races are made from carburized type steel. This permits heavier press fits, mountings of the simplest type and lowest over-all cost. When press fitting recommendations are followed, HYATT inner races become an integral part of the shaft for all practical purposes. Auxiliary retainers are practically never needed—an important cost-saving factor.

2 INTERCHANGEABLE PRECISION PARTS ELIMINATE SELECTIVE FITTING. Any separable race in the metric series of HYATT Hy-Roll Bearings will fit perfectly with any related race and roller assembly. Slow and costly selective fitting is never necessary except in the most unusual circumstances.

3 SEPARABLE CONSTRUCTION PERMITS MORE FLEXIBLE ASSEMBLY. For example, HYATT inner races can be pressed on shafts in one location while the outer races and rollers are installed in housings in another area. When the sub-assemblies are brought together the bearing parts will match perfectly without selective fitting.

4 WIDER INNER RACES ELIMINATE SPACERS, SIMPLIFY SEALING. Often an inner race from a wide or double-row HYATT Hy-Roll bearing series can be used with a roller assembly from a narrower single-row bearing series. The extra width of the inner race provides an inexpensive hardened and ground surface upon which a seal can operate more efficiently, and at the same time frequently makes spacers unnecessary.

5 UNITS CAN BE DIS-ASSEMBLED WITHOUT BREAKING PRESS FITS. The design of separable HYATT Hy-Roll bearings permits roller assemblies to be removed, in most cases, without disturbing the press fit of the inner race on the shaft, thus saving costly labor.

6 SPARE SHAFTS CAN BE SHIPPED WITH INNER RACES ALREADY MOUNTED. Gears and other parts will usually slip over separable HYATT Hy-Roll inner races, so races can be pre-shrunk in place on replacement shafts without interference with later assembly. This frequently permits important reductions in downtime and labor costs.

NO BEARINGS CARRY RADIAL LOADS LIKE *CYLINDRICAL*

IS SO MUCH SIMPLER . . .

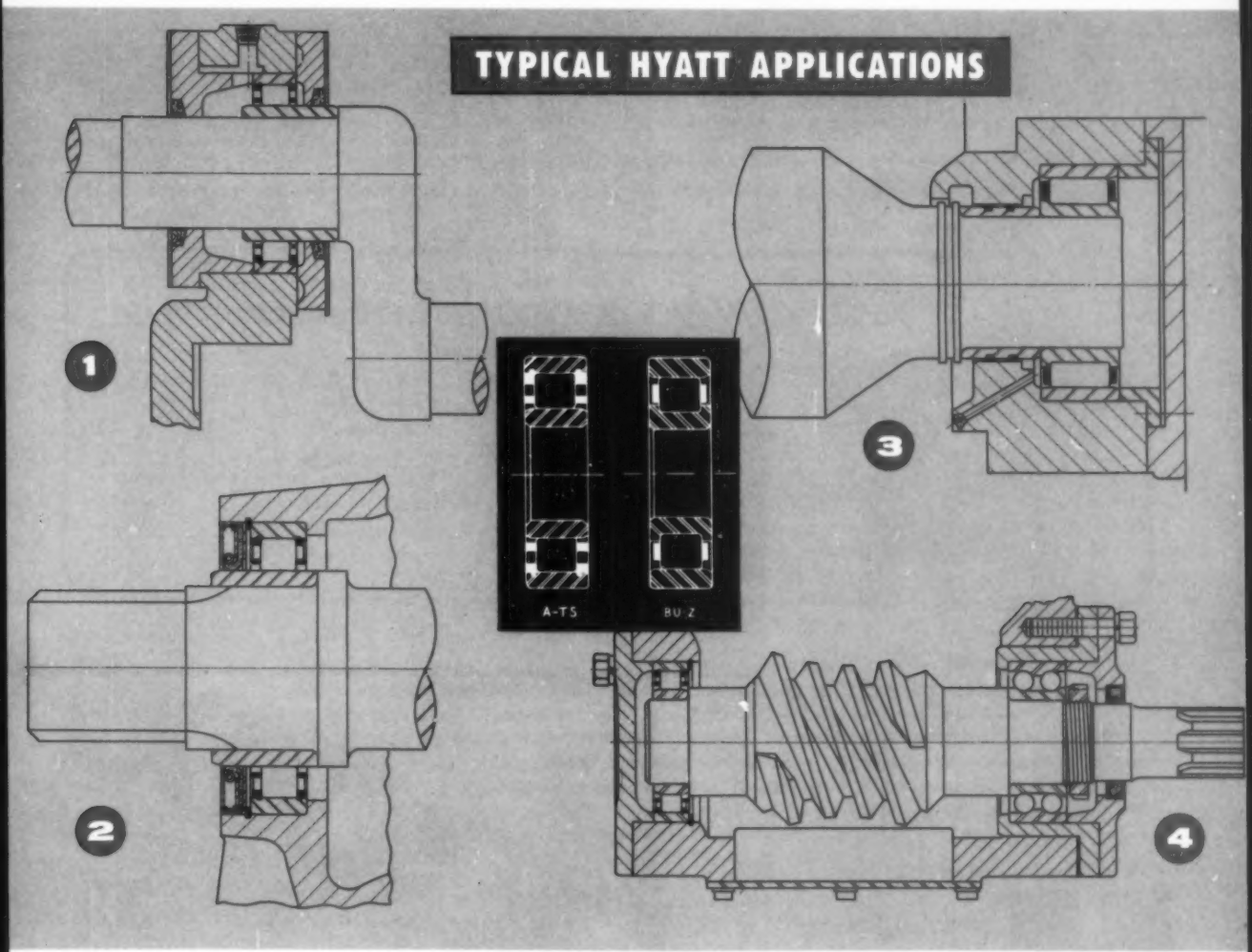
As labor rates continue to mount and the pressure to cut assembly cost increases, it becomes more and more evident that *it is not the first cost but the INSTALLED cost of a bearing that counts.* HYATT Hy-Roll bearings can help you "design in" significant installation savings which are often overlooked. Here are four concrete examples:

1 **In this loom crankshaft** an A-TS type bearing using an interchangeable inner race from a wide series bearing permits considerable end float in the bearing. This provides clearance for considerable tolerance stack in a long crankshaft. The long inner race also provides a hardened and ground surface upon which the seal can operate best.

2 **A two-part A-TS bearing** in which a long inner race is pressed on the shaft. The extra length inner race is utilized as a seal operating surface. A snap ring pressed in the housing bore serves as bearing retainment and helps to locate the seal.

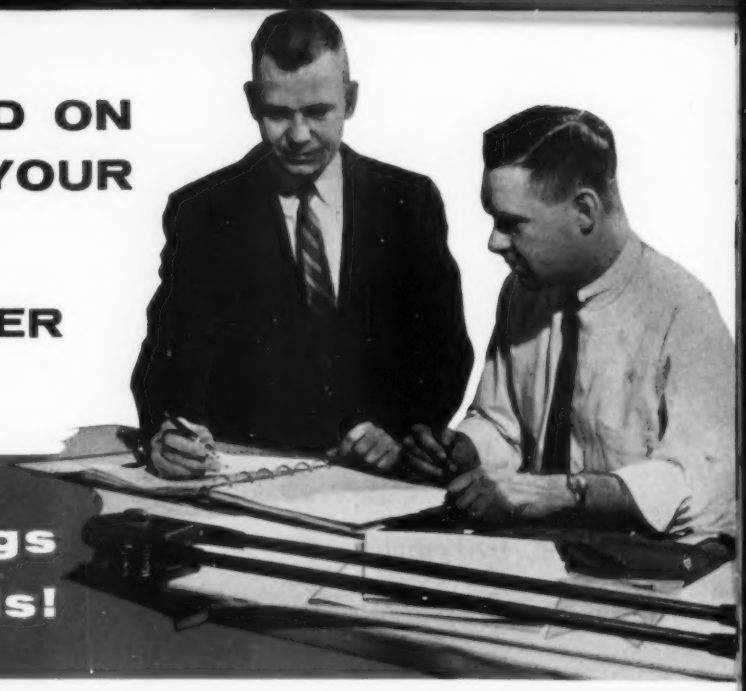
3 **In this table roll** application a BU-Z type bearing permits sufficient float through the bearing to provide for shaft expansion from high heat conditions without cramping the bearings. The use of separable outer race bearing permits easier installation and removal.

4 **In this worm and gear** application the double-row ball bearing is used for locating the shaft in both directions. The A-TS bearing at the opposite end is used with a cartridge that facilitates adjustment by shimming. Using a cylindrical bearing at one end facilitates assembly and permits easy removal of the worm from the case.



BEARINGS . . . AND NOBODY KNOWS THEM LIKE HYATT

YOU CAN DEPEND ON THE ADVICE OF YOUR HYATT SALES ENGINEER



...and the bearings he recommends!

Your HYATT Sales Engineer is thoroughly familiar with all the optional cost-saving features which help make installation, assembly and dis-assembly more economical with HYATT Hy-Roll bearings. Long experience with a wide variety of industrial bearing applications qualifies him to make intelligent recommendations which you can depend on to assure lower over-all costs and superior performance for your products.

just call your nearest **HYATT** *office:*

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REMEMBER THESE BUILT-IN HYATT BENEFITS:

- Higher radial load-carrying capacity, size for size
- Minimum space requirements
- Omitted races are optional
- Shaft location without sacrificing capacity
- Easier assembly and disassembly
- Heavier press fits simplify retainment

THE RECOGNIZED LEADER IN CYLINDRICAL BEARINGS

GM GENERAL MOTORS

HYATT HY-ROLL BEARINGS FOR MODERN INDUSTRY

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, NEW JERSEY

Measuring strain?

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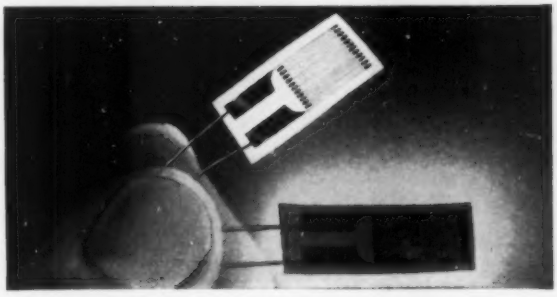
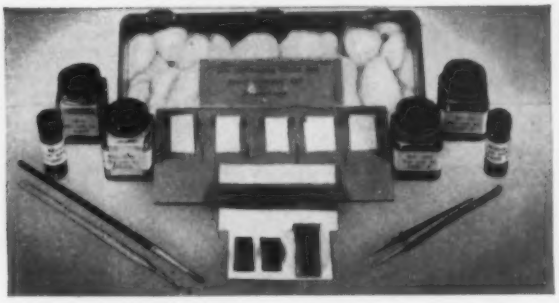
Your single source for...

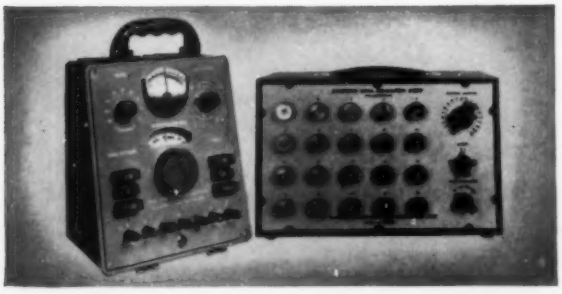
- **Over 250 different bonded wire and etched foil SR-4® Strain Gages**
- **Full line of indicating, recording and supplementary instruments**
- **Application supplies—cements, solvents and waterproofing materials**
- **Competent guidance in the selection and use of strain gaging equipment**



Why risk unreliable data by using *almost* the right strain gage. Select the one exactly suited to your application from the more than 250 different bonded wire and etched foil SR-4® Strain Gages listed in the current B-L-H catalog. High temperature, temperature-compensated, rosette and many other types are stocked by your B-L-H Sales-Engineering Representative for immediate delivery.



The proper application of a strain gage to a surface is fundamental in obtaining accurate strain data. B-L-H cements, solvents, waterproofing and lead materials and accessory equipment help you do the job right. Convenient strain gage application kits contain everything you need, including detailed instructions. Kit materials can also be supplied in bulk form in large or small quantities to suit your needs.



A full line of strain instruments—for static and dynamic strain measurements—is available through your B-L-H Sales-Engineering Representative. Instruments include (left) the B-L-H Type N Strain Indicator, calibrated to read directly in microinches per inch; (right) B-L-H switching and balancing unit, designed to facilitate bridge balancing and gage readout on multiple gage installations.

Write for these useful publications. Bulletin 4310 covers specifications and prices for over 250 wire and foil SR-4® Strain Gages, kits and accessory equipment. Bulletin 4320 treats of SR-4 Etched Foil Gages. For copies, write B-L-H, Dept. 15-H. For guidance in selecting, applying and instrumenting SR-4® Strain Gages, contact your nearest B-L-H Sales-Engineering Representative.

FIRST in strain measurement

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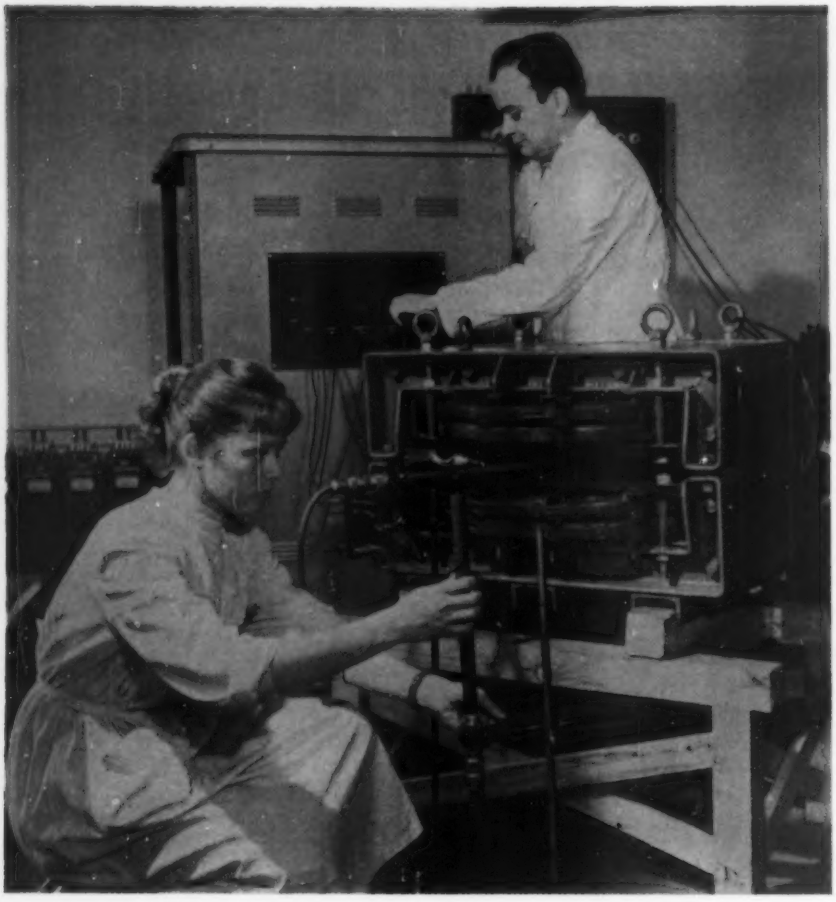
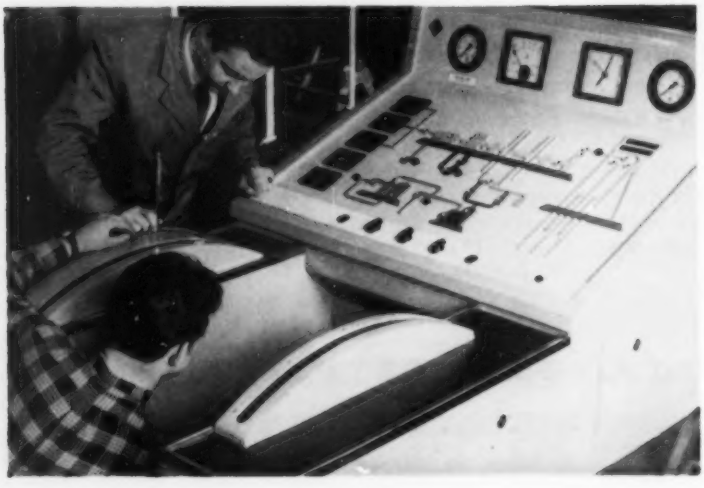
SR-4® Strain Gages • Transducers • Testing Machines

how the east german engineer



Severe engineer shortage in East Germany encourages every able boy or girl to study science or technology. Here, two students at Dresden Institute of Technology set up ionization chambers of a betatron for gamma-ray measurements.

New control panel for a mine winding engine demonstrates concern for human-engineering principles. However, industrial design does not exist as a separate course of study. East Germany feels that any competent engineer with a good grounding in esthetics can take care of appearance aspects.



A radio direction-finding unit is tested out by two engineers in an East Berlin manufacturing plant. Labor shortage here . . . aggravated by steady flow of refugees to West Berlin . . . plus apparent disparity between standards of living in the two sections, are considered the real reasons for the Berlin crisis.

Tight Soviet control has made a "dark continent" of Eastern Europe. Travel there by Western observers is even more restricted than in the Soviet Union itself. Early this year, PRODUCT ENGINEERING's editor in Bonn was given special permission to visit East Germany and Czechoslovakia. Here are his observations of engineering life in these countries.

lives and works

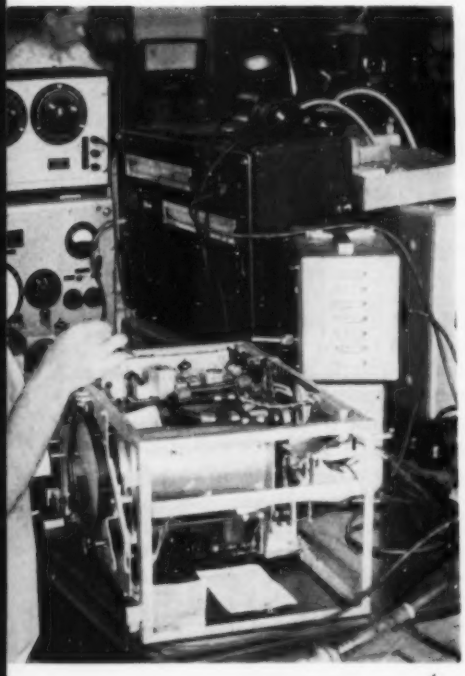
JIM MORRISON *Field Editor, Bonn, Germany*

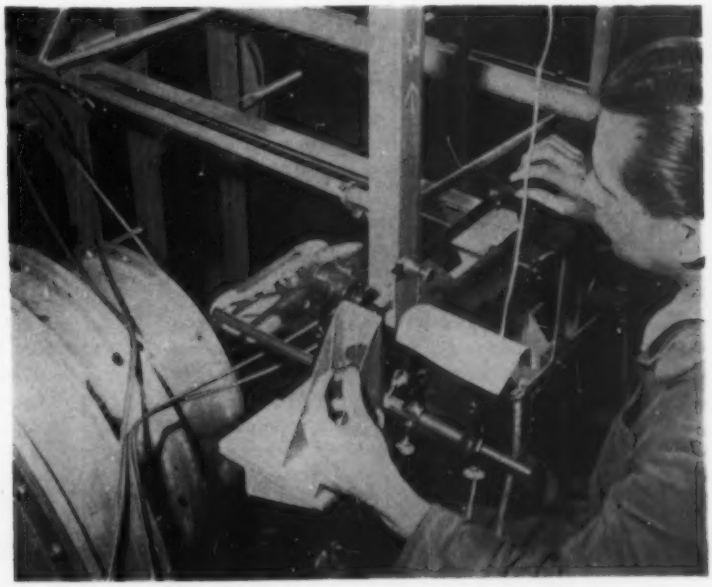
■ Youth versus age, a competition verging on open warfare in some cases, has split East German engineers into two camps—and youth seems to be winning hands down. It is commonplace to find a 27-year-old group leader, chief designer or even department head in full charge of a team of design and research engineers. Intensively schooled, politically, from a very early age, these young men have an almost fanatical faith in their country, their profession, and themselves. They have been told their country's future depends on them—that only youth can accomplish the almost impossible task of bringing East Germany to a par with West Germany.

The feeling is that older men can't direct projects with the necessary enthusiasm and drive, so they must make way for younger, more-virile stock. The downgrading that follows is only in prestige; no financial benefits are lost.

In spite of these unusual inducements for young men to study engineering, the engineering shortage is a major problem in the Soviet satellite countries. East Germany planned to graduate 4500 engineers in 1958 but actually turned out under 3500. Courses in science are preferred because here, as in Russia, a scientific career is less open to political interference and has a somewhat more secure future.

(CONTINUED ON NEXT PAGE)





Air resistance of a racing car model is measured in this rather crude test rig. Ingenuity and make-do play a large part in any East German test laboratory and even drafting room equipment and lighting are 20 years behind current American standards.

One of the very few Czech women engineers gets her degree at University of Prague. It's estimated that Czechoslovakia has lowest percentage of women engineers in the Soviet bloc (under 3%). With any technical ability at all, women can earn more operating a production machine, and enjoy higher prestige in the community as well.

Engineer salaries are standard throughout East Germany and depend more on length of service than ability or position. Trade school and college graduates (of both sexes) are paid a basic monthly salary of 780 East German marks. College graduates can rise to 1750 marks, and bonuses of from a few hundred to several thousand marks can be won for important individual or team contributions.

Real Income

What does this mean in dollars? Straight conversions of marks to dollars are misleading; the official rate is about 35¢ per mark, the free-market rate is about 7¢ per mark, but neither reflects the true state of affairs. In buying power, the income of an East German engineer is about 25% higher than that of his Soviet counterpart, but only slightly more than half that of an American engineer.

For example, a tailor-made suit of good material costs 400 to 500 marks. Ready-made suits, still unpopular in Europe, might cost 200 marks. Men's shoes cost 50 marks; women's, 36 marks (but they're not very fashionable and made of questionable-quality leather). Beef, pork and lamb run between 4 and 6 marks per pound. Butter costs about 4½ marks per pound.

However, there are hidden benefits which do not appear on the straight buying-power comparison. Government-sponsored and compulsory social security guarantees sickness payments equal to 90% of the normal salary. The payments continue for the full period of sickness to a maximum of 18 months, when a sick employe is put on full or partial pension. Payments start immediately and will be paid to a mother whose child is ill if she must stay home to care for it.

Many women work. The steady flow of refugees to the West has resulted in an acute labor shortage in East Germany, and extra incomes are very welcome to hard-pressed families. Married women engineers are encouraged to work half-days at least.

Five engineers were interviewed at length. They averaged 28 years of age; all were married, and their five families included 11 children. However, only one of the five had an apartment to himself; the others lived in furnished or unfurnished rooms. None owned a car or TV set. Two had elderly motorcycles; the rest owned bicycles.

Yet the average engineer here lives and works as well as any engineer in the Soviet bloc, except perhaps Czechoslovakia where the standard is somewhat higher. Drawing boards and office equipment are old. Lighting is poor and experimental rigs are makeshift. These conditions are considered temporary, of course. "In any case," one engineer said, "even a mediocre design engineer can master the most complicated problem with the best and most up-to-date tools; it takes a good engineer to solve the same problem with makeshift equipment and his own ingenuity." Partly true, but tasting of sour grapes.

Czechoslovakia

Engineer training here, as in most of Europe, is considered far more selective than in the US. Weeding out starts in the elementary grades and continues through entrance examinations for universities and technical schools. Roughly 60% of those applying for admission to the universities are rejected, but of the accepted group about 90% finish the course.

The engineering course averages 5½ years, with an additional 3½ years for a doctorate. This includes 36 hours of instruction, a gym class, plus 3 or 4 hours of political schooling each week.

Students are assisted by state grants of as much as 250 kronen per month (depending on the father's earnings, nothing is paid when the father earns 3000 kronen per month or more), but family assistance and summer work are usually necessary to see the student through. His room costs 200 kronen per month including breakfast. Tuition and books are free.

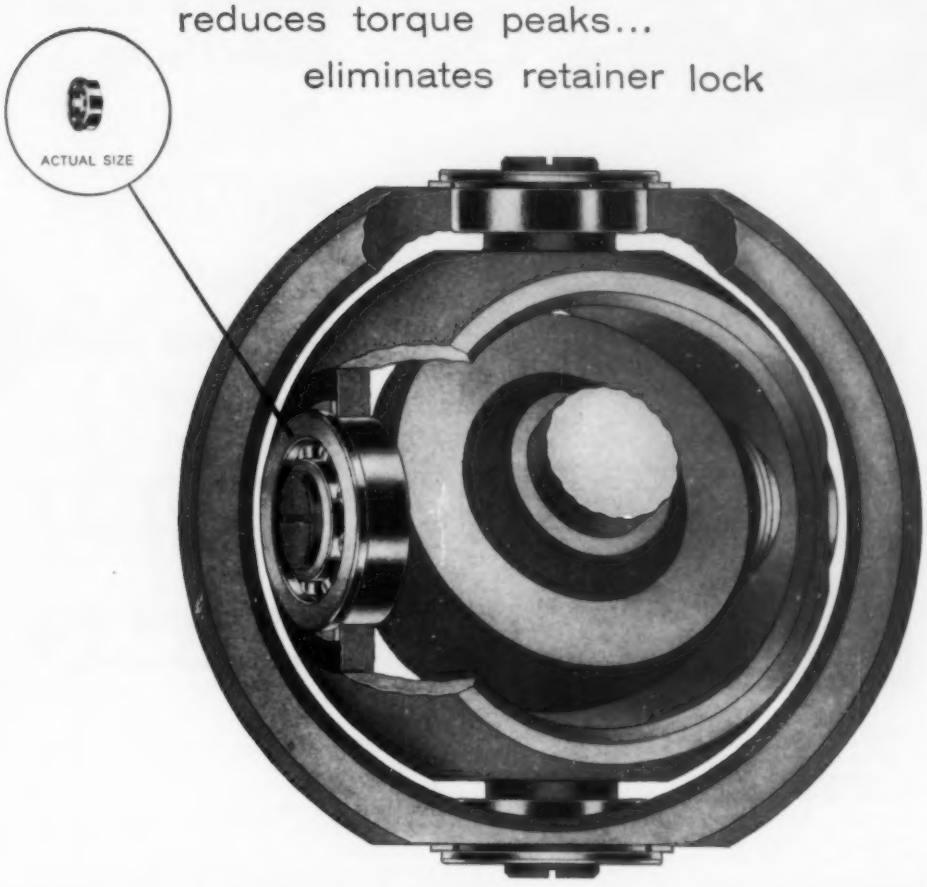
The official rate of exchange here is about 14¢ per kronen. A small-size TV set costs about 3000 kronen; a tank-type vacuum cleaner, 800 kronen; a good tailor-made suit, 1000 kronen; men's shoes, from 150 to 200 kronen. Average meat price is 23 kronen per pound.

It is characteristic of Communist countries that the graduate engineer has less official prestige than the skilled worker or machine operator—even though the latter's training is shorter than the engineer's. In Czechoslovakia a machine operator can earn up to 2000 kronen, and his tax will be lower than that of the equivalent engineer who earns only 1300 or 1400 kronen. A chief design engineer might receive as much as 3000 kronen per month—but so might a good shop foreman.

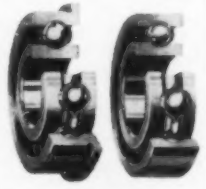
The engineer's society here is very active and attendance at regional and district meetings is a highlight in the life of the Czech engineer. He meets with colleagues to discuss problems of the professional and personal lives. Politics are rigidly barred from these functions, which is probably why they are so popular.

This freedom from political interference makes the Czech engineer a relatively happy man in a Communist satellite. He lives in a community that is more democratic than communistic and lacks few of the things that make life comfortable and pleasant. ■

BARDEN "W" retainer reduces torque peaks... eliminates retainer lock



Low-torque reliability for gyros, synchros and other torque-sensitive components



"W" retainer bearings are available flanged or unflanged, shielded or open, in sizes most in demand 5/8" O.D. and under. For complete technical information write for engineering data sheet W-1.

An instrument bearing that passes all normal torque tests can develop excessive torque peaks in operation. In gyro gimbals, synchros and similar applications the result is erratic component performance. To solve this reliability problem, Barden developed the "W" ball retainer.

Field tested and proved in actual operation, Barden "W" retainer bearings are specified for a growing number of torque-sensitive applications. • • • *In gimbals on the Sidewinder they contribute to the missile's reliability.* • • • *In attitude gyros they save one manufacturer $100 per unit by reducing costly teardown.*

Like other Barden advances in engineering and manufacturing, "W" retainers answer a specific performance problem. Other Barden Precision ball bearings satisfy such extreme demands as:

- High temperatures (to above 400°F)
- Low torque (to 10 dyne-cm. for 2 lb. load)
- High speeds (to over 300,000 RPM)
- Concentric rotation (to .00005" max. T.I.R.)

The complete Barden line includes sizes from .0469" bore to over 3" O.D., all manufactured to Barden Precision standards of dimensional accuracy, uniformity and reliability. Refer to Sweet's Product Design File (8h/Ba) for Barden catalog and bearing selection guide.

for reliability...specify **BARDEN PRECISION BALL BEARINGS**

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An IRIDITE-IRILAC finish will provide longer life for storm doors, windows, outdoor furniture, auto parts and accessories, tubing or wire goods. And, you have a choice of color finishes such as natural aluminum and golden yellow. Other colors may be obtained by an additional dye operation.

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ON ZINC

IRIDITE plus IRILAC gives your product longer life and brighter appearance. Color choices range from clear IRIDITE to olive drab, plus colored dye finishes.

IRIDITE is the tradename for a specialized line of chromate conversion coatings that can be applied to any non-ferrous metal by brush, dip or spray methods—at room temperatures—manually or with automatic equipment. Upon application, a thin film forms which becomes an integral part of the metal itself, and thus cannot chip, flake or peel. No special equipment, exhaust systems or specially trained personnel are required.

IRILAC is the tradename for a line of clear protective coatings for all metals. As safe and easy to handle as water, they may be applied by brush, dip or spray methods. No exhaust or special fire protection equipment required. Adds protection and abrasion resistance to any base metal, plated part or parts treated with electrolytic or chemical post treatments, without chemical change.

For complete technical information on IRIDITE Chromate Conversion Coatings or IRILAC Clear Protective Coatings, write for FREE TECHNICAL MANUAL. Or, see the Allied Field Engineer in your area. He's listed under "Plating Supplies" in the yellow pages.

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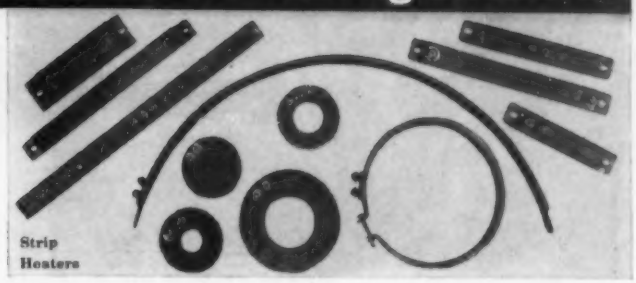
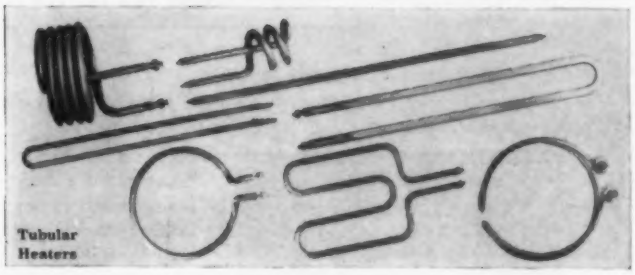
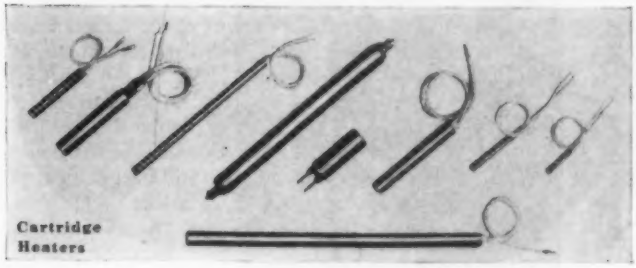


Strip Heaters



Tubular Heaters



Cartridge Heaters

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Strip Heaters . . . that quickly and easily bolt or clamp to platens, dies, kettles, tanks, pipes, rolls, drums, ovens and air ducts. Lengths from 4 to 96 inches, widths from ¾ to 2½ inches, with cross section curving or lengthwise bending. Available with brazed-on fins.

Tubular Heaters . . . that clamp on, fit into machined grooves, cast into metals, immerse in liquids, install in ovens and ducts. Straight lengths or factory-formed to nearly any contour. Lengths from 6 inches to 30 feet. Triangular or round cross section. Available with brazed-on fins.

Cartridge Heaters . . . that smoothly fit standard drilled holes in dies, platens, molds, extrusion and injection barrels. Special leads available for protection against flexing action, abrasion, moisture or vapors. Diameters from ⅜ to 1 19/64 inches, lengths from 1⅝ to 25⅜ inches.

Versatile Chromalox electric heaters are available in sheath materials and wattages to match almost any application to 1100°F. Easy to install, they are fast, clean, safe and economical.

Your Chromalox Man can help you determine the one that best answers your specific problem. He's backed by the world's largest factory stock of industrial heaters, ready for immediate shipment. Why not give him a call. You'll find his phone number listed at the right.

Our new Catalog 60 provides detailed product information and suggests numerous applications for the complete line of Chromalox electric heaters for industry. If you have not yet received a copy, please let us know.

1801

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POINTS OF

THE QUESTION: *What causes most wasted engineering time?*

JOSEPH F MANILDI
General Manager
Thompson-Ramo-Wooldridge Products Co
Los Angeles, Calif

"Management is becoming more and more . . .

cognizant of the fact that the amount of time available to an engineer for doing creative work is a definite function of the amount of effort spent by management to relieve him of tasks which can be performed more efficiently and economically by use of the latest techniques and equipment for information handling and data processing. Computers, in particular, have proved an invaluable aid to modern management in relieving its engineering staff of the tedious labor involved in doing design calculations, process analyses, data correlations, experiment design, and experimental-data reduction.

"In the process industries, there is not only the problem of gathering and analyzing data, but also that of getting accurate information on production and marketing into the hands of management in time to allow it to make the decisions necessary in today's highly complex economy. The time still wasted by engineers on routine tasks of this type can be reduced still further.

"Another problem becoming increasingly important is that of making this rapidly growing sum of information readily available to engineers. Much time is still wasted in searching for information on what has been done before in a particular field. Unnecessary repetition of design and experiment occurs because engineers in difficult laboratories and plants are unable to communicate with each other quickly and efficiently. An increasing amount of attention has been paid to these problems recently, and I hope that break-throughs in the fields of information storage and retrieval will go as far to alleviate these difficulties."

"A great amount of wasted effort . . .

is expended by engineers in correcting and reworking designs which did not perform to expectations. It is my experience and that of many engineers in management positions that engineers limit their creative and productive output by having to do over too high a percentage of their initial designs.

"This wasted effort could be largely eliminated by:

a) Planning the program in advance so the scope and approach are clearly defined, scheduled and manned to eliminate false moves.
b) More shop experience or greater familiarity with shop methods, routings and standard tools and fixtures.
c) Better supervision of design with particular attention to use of standards and the specifying of reliable elements, dimensions, tolerances and fits.
d) Review of designs by a competent board of consultants, which many designers object to.
e) Expanded use of modified testing to prove out unknown phases of a project.
f) Greater appreciation on the part of engineers that delegation of serious technical matters to subordinates does not allow an escape from responsibility and accountability."

S R HIRSCH
Asst to VP-Engineering
Worthington Corp

"Starting a design before . . .

ROGER L DANIELS
Chief Engineer
Formsprag Co
Warren, Mich

all of the information pertaining to the design is accumulated. In other words, the objective should be defined clearly and as completely as possible before any work is put into an actual design. This pertains to such things as size, operating conditions, cost, and any special considerations. One of the most wasteful things is continual changing and redesigning before the design is released, or continual engineering changes after the design is utilized for some mechanism.

"There are other items that are wasteful in engineering time. Interruptions to the engineer's train of thought while a particular design is being made, is bad. These interruptions might be idle conversation, questions about other designs or problems, etc. Another item is clerical work, such as filing prints, or reports, or looking for reports, etc. Also wasteful is longhand writing of memorandums when they could be dictated to a stenographer much faster.

"Searching for technical information is extremely time consuming. In most cases technical information has to be obtained by engineers from reference books, reports, catalogs, and magazines. Good indexing of this reference material is extremely helpful to eliminate wasteful time looking for the desired information. Long, over-written reports are wasteful as far as time is concerned. The engineer needs to be able immediately to put his finger on the facts or thoughts that are being conveyed. Report forms with headings such as; Conclusion, Test Procedure, etc., have helped make reports short, clear, and to-the-point.

"Vendors calling on engineers without arranging an appointment also wastes engineers' time. Setting up appointments through the Purchasing Departments has proven quite useful and time saving."

"Communications . . .

By communications I mean understanding of specifications not only within the Engineering Department but by other departments (Management, Sales & Service, Production and Quality Control) as well. Specifications must include approximate production and tooling costs as well as functions and features.

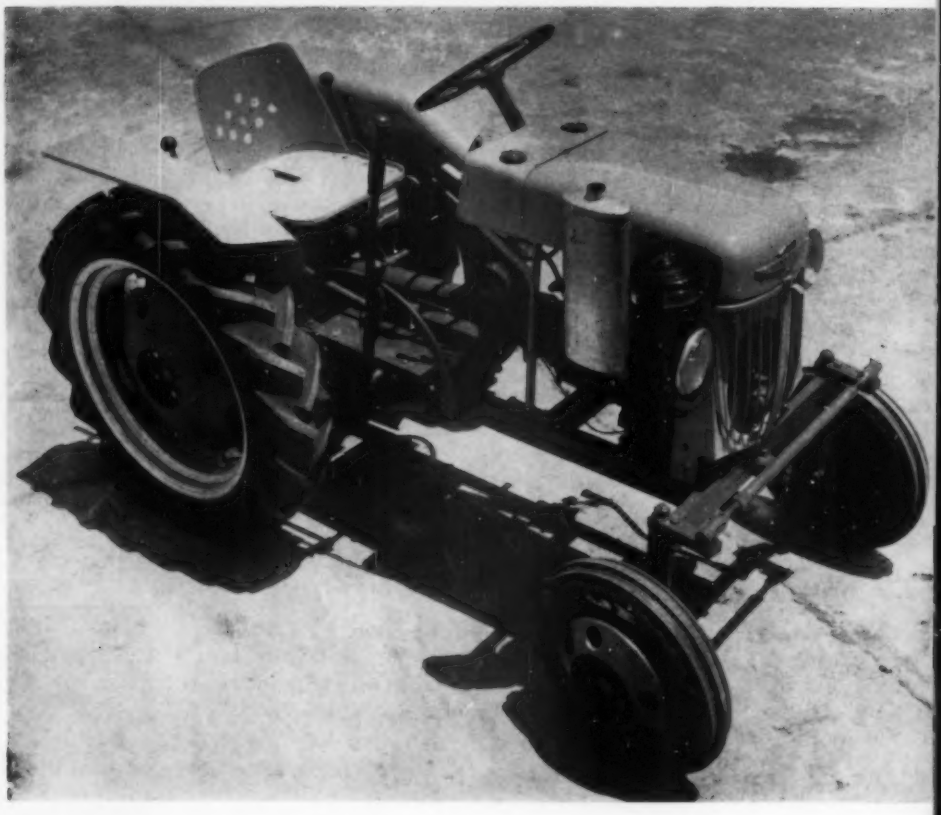
"Management's original assignment to Engineering can not always be as specific and detailed as desired. In these situations, communications become even more vital since each of the organizational functions mentioned above views the project from its own vantage point. In addition to progress meetings, one of the most effective ways of coordinating the thinking of all concerned and providing the common understanding of the job is to construct a complete model, even though crude, as rapidly as possible. Engineering work in this phase should be adequate rather than exhaustive. Maximum use should be made of model-shop facilities, with only sufficient design and detail drawings to maintain a record of the job as it proceeds. Fancy drawings can come later, thus minimizing duplication of effort due to inevitable changes.

"With the model at hand, the remaining problems and limitations can be graphically gotten out on the table and all concerned can contribute to finalizing the specification. Engineering effort can then be applied more effectively and intensively, with resulting improvement not only in the design but also the time schedule and Engineering costs."

FRANK B DIBBLE
Manager of Engineering
Voicewriter Engineering Department
Thomas A Edison Industries
of McGraw-Edison

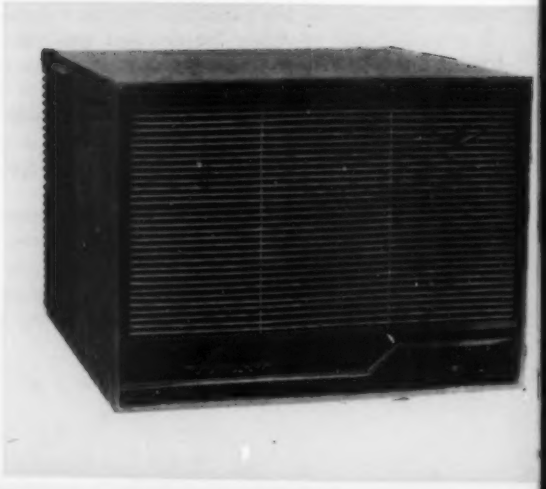
TRENDS in appearance

Automatic bakery oven



Medium-size tractor, first to be designed in Israel

Kerosene space heater, designed for Thermoil, Ltd



design... ISRAEL

US designers, Rothenberg and Karlen, discuss Israel's first espresso-coffee machine with an Israeli designer trained in office they set up in Tel Aviv.

■ In Biblical days, Israel knew how to crown manufactured articles with beauty. But centuries had passed. When young, new Israel launched its Product Design Office in 1956, with help from America's International Cooperation Administration, it had to re-teach its people.

True, hundreds of factories and workshops had mushroomed into existence—to supply immigrants streaming in from all parts of the world. And the result was hasty, rough, rather minimum products. There was little money for design services—and even less interest. The manufacturers thought it impossible to develop modern appliances and other products that would have wide enough appeal. Besides sophisticates from Western Europe and the US, there were new Israelis from tents and huts of Yemen and Libya where radios and modern appliances were a mystery. And Israel was depending on sentimental appeals to sell manufactured products abroad.

To make a start, the Israeli authorities hired Peter Muller-Munk Associates. These Pittsburgh industrial designers were asked to survey the situation and propose a program that would improve present and future products, and increase exports. Designers Paul Karlen and Mort Rothenberg from the Muller-Munk office then established the present Industrial Product Design Office in Haifa, with a number of Israelis having some background in art and design who were to receive on-the-job training.

After a seminar backed up by displays of good examples from all areas of industry, actual work began, coupled with an all-out effort to convince factory owners and directors of the need for better-designed products.

The situation was like that existing in American industry back in the 1930s. Response and acceptance was slow in coming.

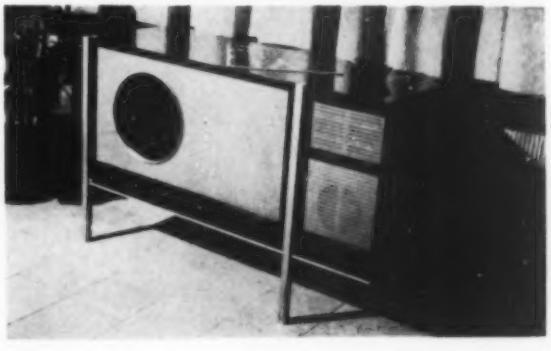
In the last three years, the Haifa office has worked on about 160 projects for nearly 65 manufacturers. Among products designed are: an automatic bakery oven, radiant room heaters, silverware, agricultural equipment, a washing machine, an air conditioner, assorted building hardware, communications equipment.

When the design group began proving that its recommendations often brought design simplification and reduced manufacturing costs, more manufacturers started taking advantage of the new services.

Paul Karlen says, "Today we have more assignments than we can handle. Indications are that there is already room for two or perhaps three additional industrial design groups in Israel." The Israel Institute of Technology has set up under its Faculty of Architecture an Institute of Industrial Design, primarily to provide formal training in this specialty, but also to provide information to industry and the public.

And according to Nathaniel Cohen, US-born Israeli designer who will probably take over as director of the IPDO when Karlen and Rothenberg leave, "It was soon realized that it was up to the designer to devise, say, a practical electrical iron and offer it to the public. Our experience shows that both the former German hausfrau and the former tent-dweller from Libya want the same things in a manufactured product: a pleasant-looking and light object, easy to handle, easily cleaned and at a reasonable price." Cohen and his American counterparts, Karlen and Rothenberg, even believe that when peace comes to Israel and her neighbors, her skills in applying good design to manufactured products will help speed the reconstruction and industrialization of this once-great world center of the arts and science.

Air conditioner, designed for Amcor



High-fidelity speaker enclosure, designed for Amron Ltd

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Before you design or produce any part or product, have it priced in aluminum. Basic material costs do not determine part costs. New techniques and processes, possible only with aluminum, can often give you a better product at a lower final cost.

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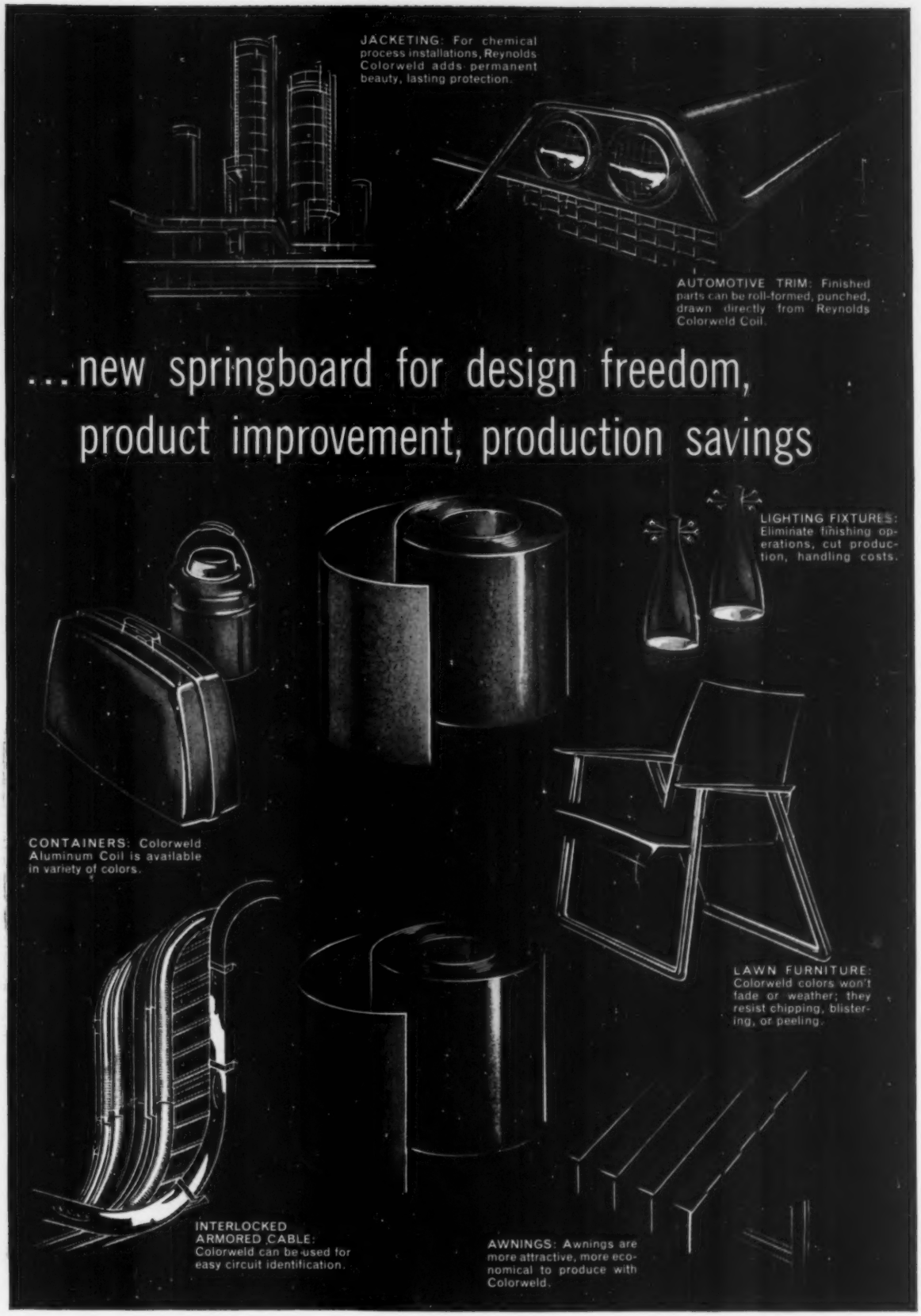
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...new springboard for design freedom, product improvement, production savings
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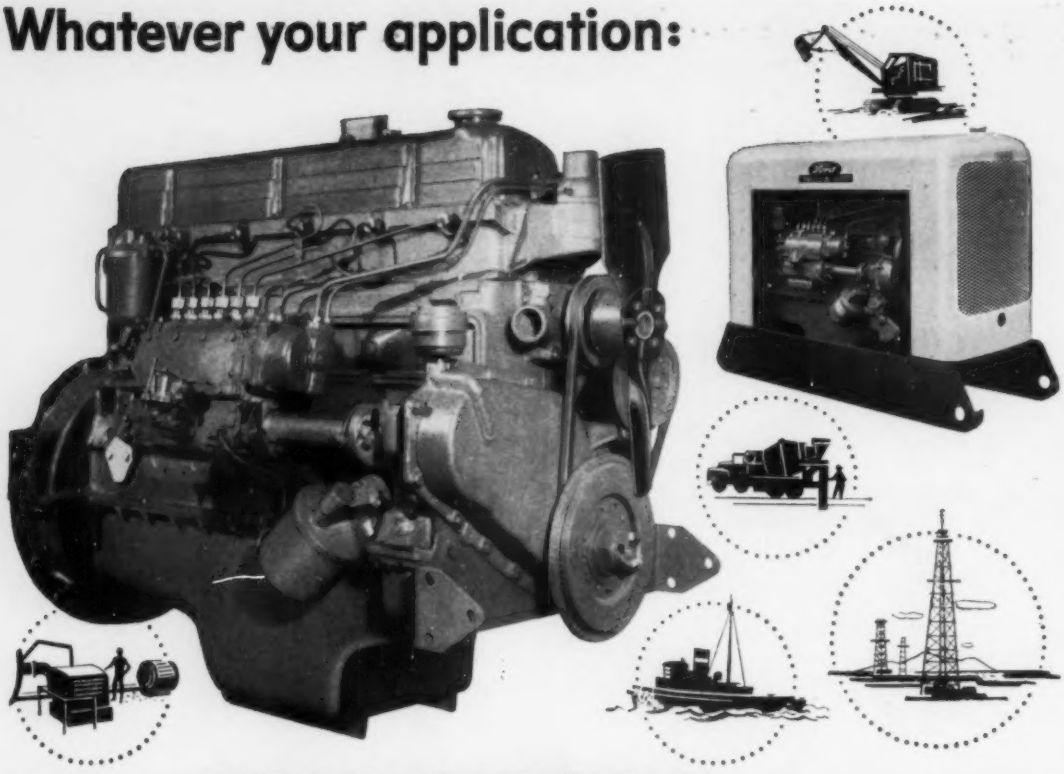

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Number of Cylinders		Four	Six
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Displacement—Cubic Inches		220	330
Brake Horsepower	Dynamometer	60 @ 2250	96 @ 2250
	Continuous	48 @ 2250	77 @ 2250
Torque	Dynamometer	151#' @ 1600	236#' @ 1600
	Continuous	121#' @ 1600	189#' @ 1600
Compression Ratio		16 to 1	16 to 1

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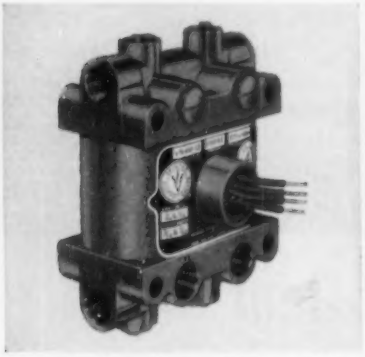

For double-acting cylinders . . . Skinner 4-way V9 valves. Two 3-way valves in one housing offered normally closed-normally closed, normally open-normally open, and normally closed-normally open. Available with adjustable flow features for exceptional cylinder control. Orifices: 3/64″ to 1/8″. Pressure ratings to 200 psi.

Exhaustive lab tests assure that you can use any Skinner valve with confidence. Built to the highest UL standards, Skinner valves are completely tested and checked to provide the best product available. Skinner's testing standards meet or surpass those of the aircraft industry.

A complete line of 2-, 3- and 4-way solenoid valves. There's a Skinner valve for almost any flow application with a wide variety of media: air, oil, water, inert gases, hydraulic fluids, kerosene and gasoline. Orifice sizes range from 3/64″ to 1″. Pressure ratings range from vacuum to 3000 psi. Explosion-proof models are UL approved for Class 1, Group D and Class 2, Groups F and G.

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SIGNIFICANT COMPONENTS MATERIALS PROCESSES

Decimal display of position . . .

of rotary or linear moving member is presented from shaft position input of analog-to-digital converter, slaved to moving member. Combines in single housing, position display and manual origin selector. Produces display of position in any desired number of digits preceded by + or − sign, indicating direction of movement from origin. Manual origin selector consists of row of selector switches with 10 detent positions. Switches are used to zero-set display to read position from new origin. Once selector switches are set for preselected reference point, circuitry automatically performs offset calculation throughout travel of the moving member. Each digit is handled by separate transistor-equipped module. Standard unit, however, consists of six digit modules and a + or − module, 10 x 22 x 22 in. deep. About $2800. 90-day delivery. **Norden Div, United Aircraft Corp, 13210 Crenshaw Blvd, Gardena, Calif.**

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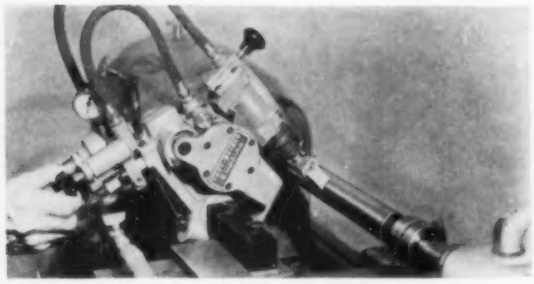

Low-pressure, low-temperature surface-finishing process . . .

developed in Germany, utilizes bonded abrasive stones consisting of silicon carbide or aluminum oxide of various grit sizes. Bond is said to permit stone to shape itself readily to work radius or shape and to wear away uniformly. Can generate finish to less than 1 microin. Finishing is accomplished by attachments that will fit engine lathes, turret lathes, boring mills or planers. Stone is oscillated parallel to work axis by pneumatic system. Attachments cost $985 and $1585 (for heavy-duty model); filter wagon and rinsing fluid piping, about $430 additional. Basic stones, in packages of 5, are $5 to $12 for 500-grit or coarser; $7 to $18 for finer grits, depending on size. From stock. **Taft-Peirce Mfg Co, Woonsocket, RI.**

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Porous nickel . . .

made of pressed and sintered nickel powder is capable of operating at temperatures up to 575 F. Made in 12 x 30-in. sheets and 2-ft x 12-in. dia cylinders. Max thickness, 1 in. Was developed for use as noncontacting conveyor, with materials riding over it on cushion of air forced through pores of metal. Pore diameters can be tailored to specifications between limits of 1 to 45 micron. Yield strengths go up to 10,000 psi. Pilot-plant prices on request. **Corning Glass Works, Corning, NY.**

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Inflatable metal tubing . . .

is of seamless, light-wall construction and can be shipped as a rolled-up ribbon, ready to be inflated at point of use or after installation. Wall thicknesses range from 0.004 to 0.125 in. Diameters range from approximately 0.026 in. to 6 ft ID. Maximum length is said to be limited only by size of equipment used. Can be made in steel, stainless alloys, aluminum and other alloys. As produced by rolling process, tubing has integral fins or ribs on outside, which can be removed or left as stiffeners. Can be inflated by hydraulic, pneumatic or mechanical means. Thinner wall tubing has been successfully inflated by water tap pressure. Ready for delivery this autumn. At present, priced comparably or less than conventional thin-wall tubing of same dimensions. **Wolverine Tube, Div Calumet & Hecla Inc, 17200 Southfield Rd, Allen Park, Mich.**

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Heated rubber pipe . . .

made of Buna-N, is heated by an imbedded silicone rubber heating tape. Will withstand temperatures to 248 F. Can be made, too, from PVC, Penton, nylon and various metals to suit temperatures and shock requirements; with liners of silicone rubber, PVC, metals, Teflon, glass; and can be furnished insulated. To be made in a variety of lengths, with 1 to 6 in. dia in Buna-N and to 12-in. dia in other materials. 10-ft section weighs about 7½ lb. Sections can be interconnected to provide longer lengths. Pipe, to specs, available in experimental quantities. Delivery about 1 wk. **Luzerne Rubber Co, Muirhead Ave, Trenton, NJ.**

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metals engineer
material specifier
product engineer
value analyst
designer
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BUT CALL ME SMART

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SIGNIFICANT COMPONENTS
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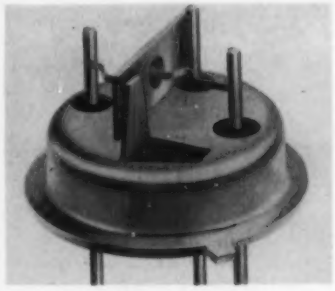

High-speed transistor . . . of PNP geranium-alloy junction type uses thermal bond construction. Transistor junction tab is bonded to unit base plate for electrical insulation and increased heat dissipation. For use in high-current computer applications, device is designed to withstand 20,000-g centrifuge and exceed MIL environmental specifications for shock, vibration, centrifuge and resistance to salt spray and moisture. Said to show excellent current-gain linearity (low beta fall-off). Thermal resistance derating is reported to be lowest for electrically insulated devices. **Tung-Sol Electric Inc, 1 Summer Ave, Newark 4, NJ.**

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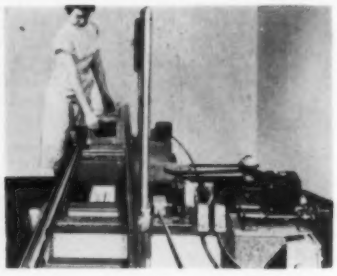

Automated soldering system... integrates product conveying, flux application, solvent removal, flux and board preheating and soldering. Provides continuous, straight-line, single-level processing of electronic and machine components up to 9½ in. wide, depending on size of soldering unit employed, and up to any practical length. 24-in.-long printed circuits are being commercially soldered with this system. Heart of system is machine that brings molten solder up to under-surface of assembly rather than dipping work into static solder bath. Solder is forced, by impeller pump, through elongated nozzle so that it forms standing laminar wave, which allows straight-line processing. Production speeds of 1 to 15 fpm are said to be particularly suitable for short runs.

(Continued on page 56)

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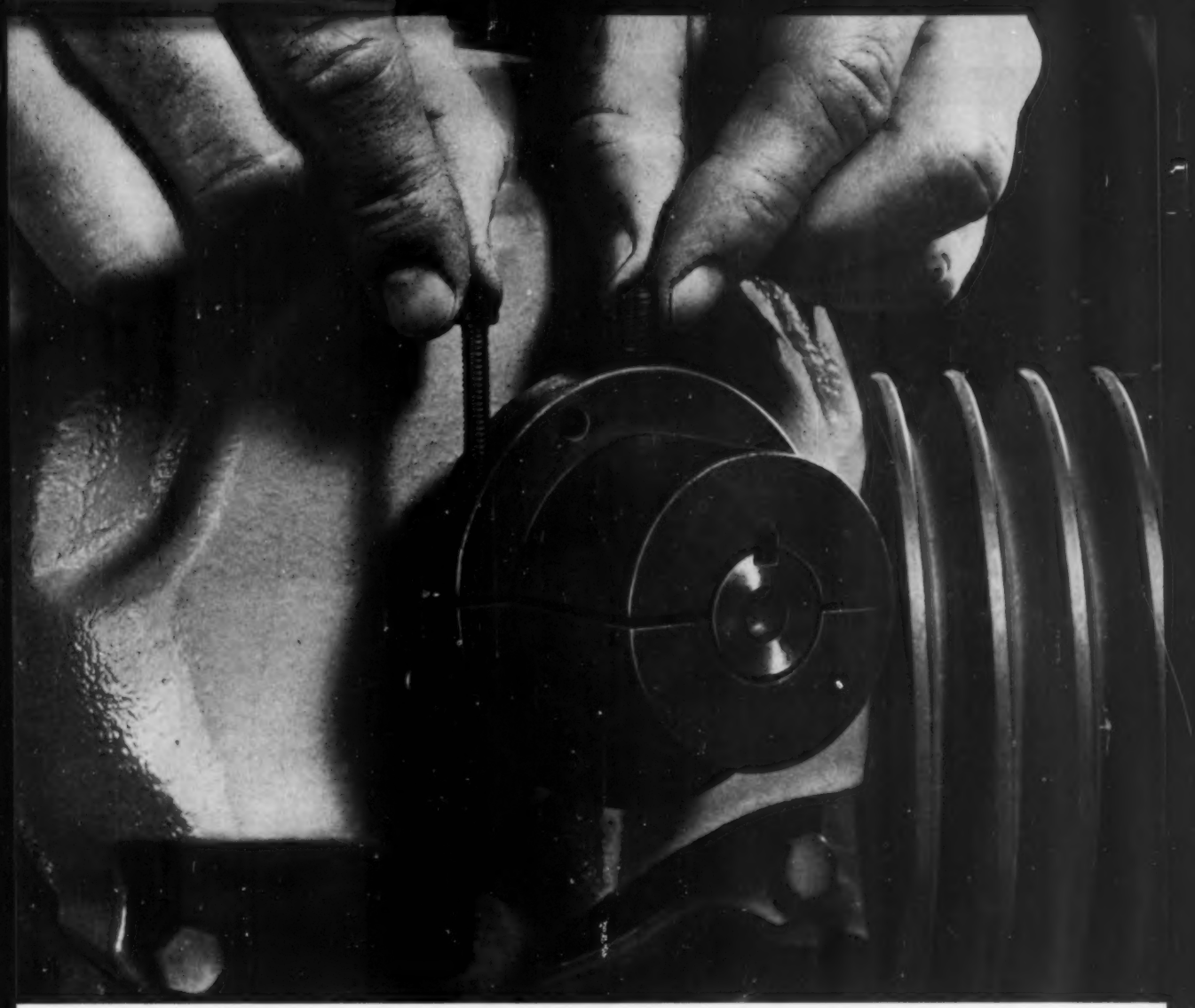

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To demonstrate to you that the exclusive two-screw design is practically worth its weight in gold, all Worthington QD (Quick Detachable) sheaves now have two golden screws.

The clamp screw simplifies installation and assures permanent alignment. You can install QD sheaves one part at a time. No heavy rim and hub combination to delicately inch into place. You just slide the hub on the shaft and permanently lock it in position with the clamp screw. Then you slide the sheave rim into position on the hub. This job is simplified because you engage the large end of the sheave with the small end of the hub. To change speed you simply install another sheave on the hub which remains anchored to the shaft by the clamp screw.

The set screw prevents "key drift." It locks the key securely in place, avoiding the danger of the key drifting off and becoming a safety hazard. This feature is appreciated by plant operators who first brought this potential danger to Worthington's attention.

You tighten the set screw without distorting the hub. The clamp screw allows you to locate the hub on the shaft. The locked hub then permits you to tighten set screw on key without distortion.

You can get Worthington QD sheaves anywhere in the U.S. More than 350 distributors carry Worthington sheaves and Worthington-Goodyear Green Seal V-belts. For your copy of a 100-page Multi-V-Drive Manual on how to select the right sheave and V-belt write to Worthington Corporation, Section 79-15, Oil City, Pennsylvania. In Canada: Worthington (Canada) Ltd., Brantford, Ontario.

WORTHINGTON

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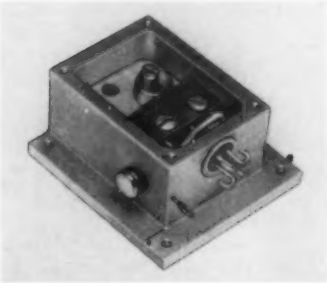
3110 Oakridge Drive, Dayton 17, Ohio Canadian plant at: Ste. Thérèse de Blainville, Québec

SIGNIFICANT COMPONENTS MATERIALS PROCESSES . . .

(Continued from page 54)

Smooth solder wave allows flux gases to escape and washing action of constantly moving metal prevents trapping of gases or air at joints. Fluxing unit applies liquid flux by means of wave similar to solder wave. Applicator provides height control to prevent over-fluxing and consequent faulty soldering. **Electrovert Inc, 124 E 40 St, New York.**

Circle 107, Reader Service Card



Timer fits into 1 cu in. . . .

of space and weighs less than 4 oz. Available over time range of 1 to 20 sec with accuracies of 3 and 5%. Mechanical device is said capable of withstanding environmental hazards of missile operation. Performs in ambient temperatures from −65 to 250 F, shock of 300 g for 20 millisec duration, and vibration of 25 g from 25 to 2000 cps. Applications include use as events programmers and timers. **Timech Corp, 13866 Saticoy St, Van Nuys, Calif.**

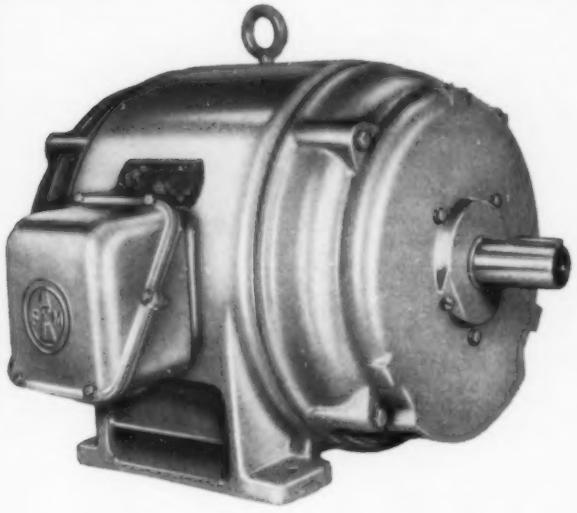
Circle 108, Reader Service Card

Pure dc solenoids . . .

are offered in two fundamental series, a pull type and a push type. Ranges from 2.25 to 12 in. dia and from $3\frac{3}{16}$ to $17\frac{5}{16}$ in. over-all height. Principally designed for operation on continuous duty without use

(Continued on page 58)

Now—F-M Spiro-duct cooling!



Spiro-duct double-end system: In standard motor shown, air enters shaft end and discharges between feet on conduit box side of motor. Conversely, air entering free end discharges opposite conduit box. In motor with conduit box located opposite to standard position, direction of air flow is reversed in relation to drive shaft location.

Spiro-duct moves cooling air in clockwise spiral direction, through space between stator core and motor frame.

Cools entire core and winding regardless of direction of rotation!

From the research and development laboratories of Fairbanks-Morse comes Spiro-duct cooling—the most effective design available for positive cooling of Dripproof motors—available now in F-M rerated KZK motors, in frames 364U through 445U.

Two completely independent paths for cooling air are provided in the Spiro-duct double-end system. All portions of the stator core and winding are thus assured equal cooling, regardless of direction of rotation.

With completely redesigned and improved enclosure as well as ventilating system, Fairbanks-Morse offers an exceptionally cool motor with maximum protection against falling particles or dripping liquids.

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A DIVISION OF TEXTRON ELECTRONICS, INC.

1076 State Street

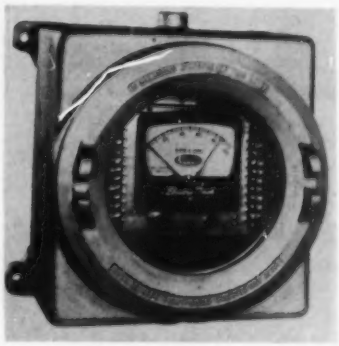
New Haven 11, Connecticut

SIGNIFICANT COMPONENTS MATERIALS PROCESSES . . .

(Continued from page 56)

of protective switch to reduce current after plunger moves into sealed position, but also available with protective switch or time-delay relay. Pull capacity, when used without protective switch, ranges from about 4 lb at 0.5-in. stroke to 100 lb at 7-in. stroke. Pull, with protective switch, ranges from 10 lb at 1¼-in. stroke to about 600 lb at 7-in. stroke. Available bottom-, top-, or wall-mounted; plunger flush with or projecting out of the frame. For shunt connections, available up to 750 v; for series connections, available for any value of current consistent with size of solenoid and to withstand up to 750 v to ground. **Trombetta Solenoid Corp, Milwaukee.**

Circle 109, Reader Service Card



Transistorized tachometers . . .

measure speed without physical loading and control associated circuitry such as overspeed and underspeed control circuits. Sensing device is magnetic pickup. Angular velocity of shaft projections or rotating gear induce signal in pickup corresponding to frequency of revolution. Pickup signal is converted by tachometer to dc directly proportional to frequency of pickup signal. Readings are provided by meter-relay unit with scale calibrated in rpm units. Accuracy of indication is 2% of full scale. Individual models offer various control pointer arrangements. Units operate on 117 v ac, 60 cps and are available in a number of housings. Unit shown is mounted in explosionproof enclosure. **Electro Products Laboratories, 4501 N Ravenswood Ave, Chicago 40.**

Circle 110, Reader Service Card

Miniature check valve . . .

utilizes separate ball for each of two inlets. If both supply pressures fail, the two inlets are immediately sealed, preventing bleed-

(Continued on page 60)

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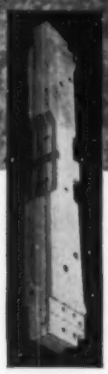

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SIGNIFICANT COMPONENTS MATERIALS PROCESSES . . .

(Continued from page 58)

off of downstream pressure. High pressure of one inlet shuts off low pressure of alternate inlet and holds it closed until pressure of second inlet becomes higher of the two. Body is rated for 100 psi max and 300 F max. Dimensions are 1⅜ x 2 in. wide. **George W Dahl Co Inc, 86 Tupelo St, Bristol, RI.**

Circle 111, Reader Service Card

High-speed counter . . .

is external pinion type. Has ¼-in. wheels displaying ⅛-in. white characters on black. Original application was in aircraft fuel-flow meter, but may be adapted to many applications requiring small over-all size, high speed and low torque. Non-reset wheels are nylon. Max torque is 0.010 in.-oz at 77 F and max operating speed is 1000 rpm. Counter weighs ¼ oz. **Instrument Div, Veeder-Root Inc, Hartford 2, Conn.**

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Servomotor generator . . .

(size 11) for 60-cps systems is driven by 6.3-v filament supply. Generator takes power input of 3.8 w with power factor of 0.99. Excitation input up to 26 v is available. Features stainless steel housing and encapsulated windings; weighs 7.5 oz. Operates continuously at stall at unit temperature of 392 F. Motor control phase is wound for 40-v; centertap, fixed phase for 57½ v. Windings can be altered to go as high as 115 v. No-load speed is said to be 3200 rpm; torque at stall, 0.65 in.-oz; acceleration at stall, 35,400 rad/sec². **Helipot Div, Beckman Instruments Inc, 2500 Fullerton Rd, Fullerton, Calif.**

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Precision Teflon balls . . .

with dimensional tolerances of 0.001 in. and less are now being produced in seven diameters, from ⅛ to ½ in. in $\frac{1}{64}$-in. increments. Method of production allows six additional diameters, varying from seven stock units by $\frac{1}{32}$-in. increments. Sphericity is within 0.002 in. **Tri-Point Plastics, 175 I U Willets Rd, Albertson, NY.**

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THEORY and DESIGN of SMALL INDUCTION MOTORS

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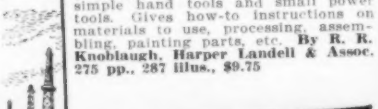

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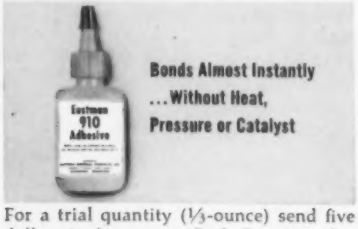

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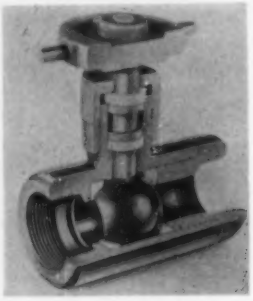

Rigid vinyl ball valves . . .

for use in piping systems are said to offer resistance to oils, acids, alkalies and most chemicals. Except for seats and seals, valve is made of Geon. Available with threaded or weld ends or flanges, valves are self-compensating for changes in pressure or temperature. Said to be effective at full pressure or vacuum. Requires no lubrication. **Jamesbury Corp, Worcester, Mass.**

Circle 115, Reader Service Card

Silicon PNPN device . . .

turns on with application of low-level positive pulse and stays on without need for sustaining base current. Negative pulse to the base turns it off. Designed for bistable switching in the range of 1 to 8 milliamp collector current, semiconductor device has circuit equivalent characteristics comparable to flip-flop or bistable multivibrator. Particularly useful for memory, logic, counting, timing and gating functions. Usually, single unit will perform same function as two transistors plus several associated capacitors and resistors. **Solid State Products Inc, 1 Pingree St, Salem, Mass.**

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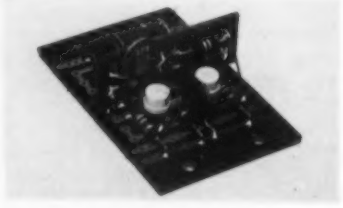

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can be constructed from this selection of 10 basic printed circuits, which are said to cover all functions for analog and digital applications. Introductory kit, containing 10 basic boards and a manual, costs $12.50. **Dynex Inc, 324 Langton Ave, Los Altos, Calif.**

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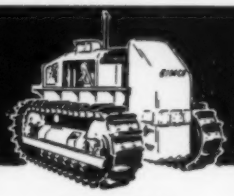

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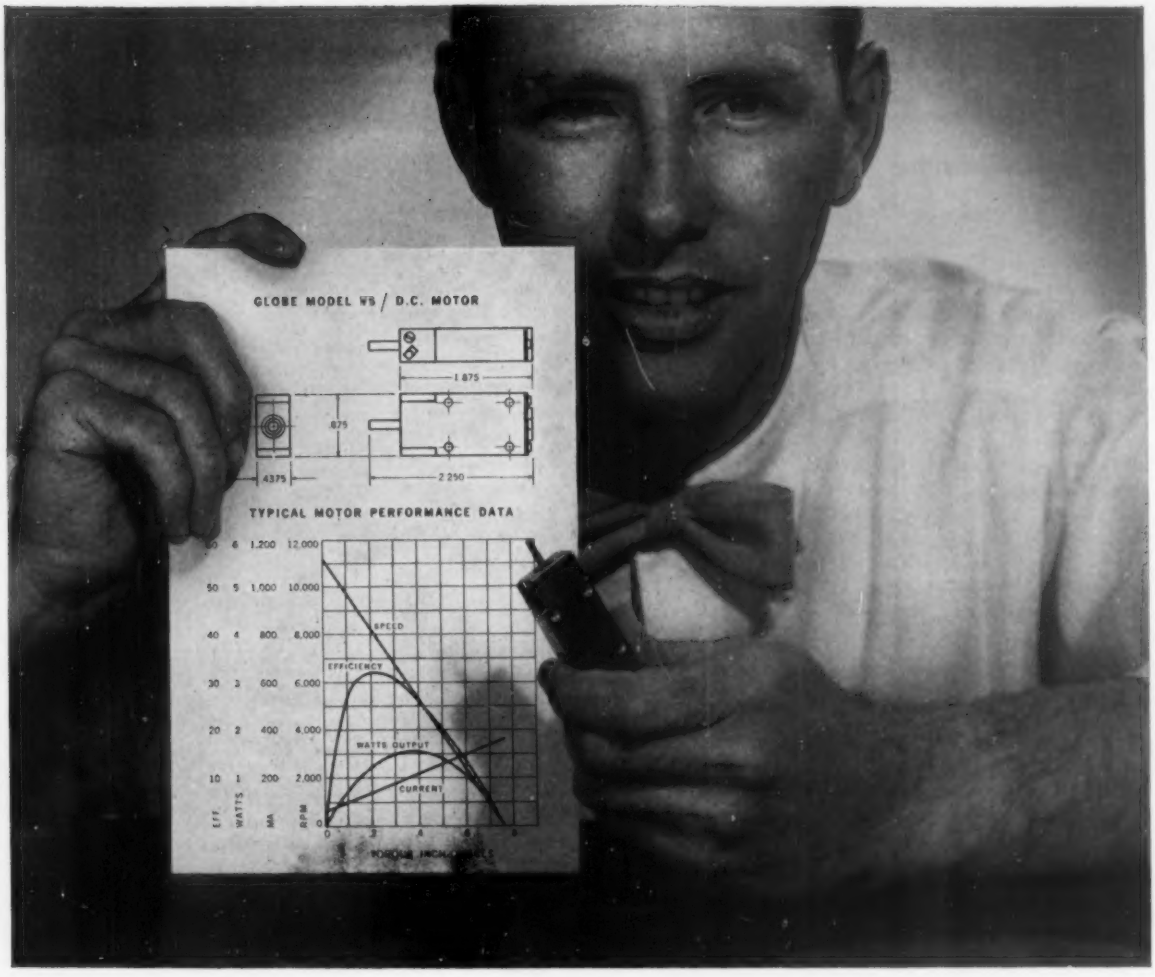

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NEW LITERATURE

The Great Decision

MICHAEL AMRINE. G P Putnam's Sons, 210 Madison Ave, NYC. 251 pp, 6 x 8½. $3.95.

Physicists and engineers produced a bomb and, with it, a dilemma. Secy of State Simpson called it "the most terrible weapon in all human history"—yet decided Hiroshima was a strategic necessity. But Adm Leahy, the President's personal Chief of Staff, wanted no part of this blow "against the civilized laws of man . . . basically distasteful to the soldier and sailor of my generation." And the scientists at Alamogordo and other R & D focal points? They too were divided.

This skillfully written, highly documented book is subtitled **The Secret History of the Atomic Bomb.** It supplies background for those of us who remember Hiroshima, will be an eye-opener for the younger crop of technical men. In what Mr. Amrine calls the Golden Age of Physics ". . . these men talked of thousands of tons of energy, as if energy had weight . . . they talked of millionths of a second." Engineers were in there pitching too. The gaseous-diffusion process for screening out U-238 needed nickel-plated holes one-millionth of an inch in diameter. And then there had to be a way of creating the implosion that would produce the grand explosion.

But this is not a purely engineering book. Vast questions concerning political wisdom and civilized morality are thrashed out here too. Should there have been a Hiroshima . . . and a Nagasaki . . . and then the Cold War? Mr. Amrine doesn't give easy answers but does add to more intelligent understanding of debates still going on.

—WG

The Logic of Scientific Discovery

KARL R POPPER, Professor of Logic and Scientific Method, University of London. Basic Books Inc, 59 Fourth Ave, New York 3. 480 pp, 6¼ x 9½. $7.50.

This book is not easy to read, but the engineer who tackles it will come away with a better understanding of the methods and mental processes, the philosophical and social circumstances affecting scientific workers, including many of those on whose accomplishments much of his own professional resources as a designer is based. Popper analyzes the philosophical and scientific schools supporting the inductive and the deductive theories of scientific discovery. He discusses the relationship and procedures linking the construction of a theory, the testing of it and the process of corroboration.

Originally published in German in 1934, this is the first time this volume has appeared in English. Translation is by the author. The original text is unchanged, but new appendices and footnotes bring the book up to date, and also give Popper opportunity to indicate where he has changed his opinions during the last quarter century.

—JK

NAMEPLATE DESIGNING—Booklet, 20 pp. Guide to designing or specifying nameplates for new products. H G Dietz Products Co, 12-16 Astoria Blvd, Long Island City 2, NY.

Circle 121, Reader Service Card

ADVANCED FACILITIES FOR STRUCTURAL TESTING—Booklet, 20 pp. Describes laboratory facilities for test programs in vibration, shock, acceleration, static, hydraulic, electrical, thermal and acoustic testing and evaluation; as well as for conducting experimental stress analysis. General Electric Co, Room 4B, 3198 Chestnut St, Philadelphia 4.

Circle 122, Reader Service Card

INTERNATIONAL INCH—Brochure, 8 pp. Discusses potential problems resulting from changeover to International Inch. Includes chart to determine whether difference between old and new inches will be significant for a particular job of specific dimensions and tolerances and a chart by which measurements made in US inches can be converted to International inches. Both charts are also offered in pocket-size form. Pratt & Whitney Co Inc, Charter Oak Blvd, West Hartford 1, Conn.

Circle 123, Reader Service Card

PRODUCT PLANNING—Booklet, 12 pp. Tells how to make a product line audit in areas of policy, organization and procedures. Examples from industry are quoted liberally and included is organization chart for product planning. Author is Edgar W Nelson. Market Planning Corp, 642 5th Ave, New York 19.

Circle 124, Reader Service Card

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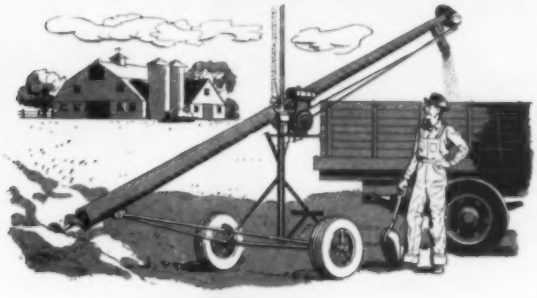
4-cycle
Short-stroke
Air-cooled

KOHLER ENGINES

MODEL
K91



MODEL
K662

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For Your Information (personal)

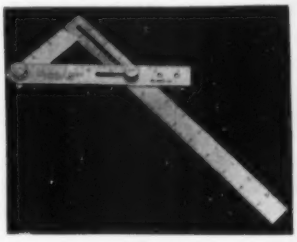
Build-your-own thermoelectrics

Want to try out the Peltier Effect or the Thompson Effect (*PE*—May 4, p 32) or see how thermoelectricity can operate a heat pump? H E Cotter and Minnesota Mining have just the thing for you.

From Cotter, 15766 Blackstone, Detroit 23, 25¢ will bring a sample thermoelectric element (a bimetal combination of iron and a copper-nickel alloy), and additional elements and instruction leaflets are available at modest cost.

It will set you back about $75 to get the 3M heat pump kit pictured above; but, says Minnesota Mining, it contains a complete, assembled heat-pump unit, extra P-type and N-type elements, and will provide a basis for judging the feasibility of thermoelectric devices of this type for various cooling, heat-transfer and temperature-control problems. "New semiconducting materials, with higher pumping efficiencies," says 3M, "have improved the performance of heat pumps to the point where practical devices can be manufactured."

They call it a "Squangle"



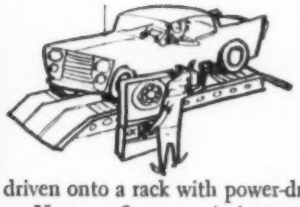
For squaring and short-leveling, scribing and sawing, Squangle Corp, Lynwood, Wash, offers the combination tool pictured here. Made of aluminum and featuring colored-liquid leveling vials on each arm, it will, the company says, "level, plumb, measure, and do almost everything a framing or combination square will do." Furthermore, it can be used as a guide for power-saw cutting and will measure pitch of rafters and roofs. Price is $6.45—with, the company says, a money-back guarantee.

Throw-aways you'll keep

Paper raincoats are here at last. But they're not quite as "disposable" as had been promised (*PE*—Sep 9 '57, p 8). Like the paper tents which preceded them (*PE*—Apr 6, '59, p 59), they're designed for one-season, not one-time use. First models, scheduled for delivery in September, will be priced at about $2 each. Since plastic raincoats are available in the same price range, why bother with paper? The manufacturer, Disposables Inc, 11 Mercer St, New York 3, says the paper ones are opaque, attractively styled, can be supplied in pastel colors (the first ones are aqua), and will "breathe." They should, therefore, be more comfortable than the plastic variety.

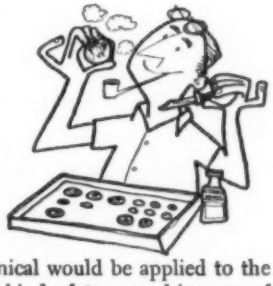
Why Don't They

R ESEARCH and D EVELOP . . .



. . . a quick, simple method for inspecting automobile tires for breaks, bruises, nails, stones, glass. At present, it is necessary to take the casing off the rim to make such an inspection. If, for example, the automobile were driven onto a rack with power-driven rollers for rotating the wheels, an X-ray or fluoroscopic instrument could detect defects. A quick inspection before leaving for a long trip would warn of possible blowout or flat tire. —F BUEHLER

. . . a simple detector that would sound a warning when concentration of carbon monoxide reached a dangerous level. If it became mandatory to install such a device in garages and houses heated by oil or kerosene stoves, the many deaths which result from CO poisoning could be avoided. The detector should be self-contained and reliable. Once installed it should not require maintenance or attention. Perhaps it could be done this way: an excessive concentration of CO would cause a chemical reaction that sets off an explosive or spring-powered alarm. —G WENKE



. . . a nondestructive methed to show grain orientation of a metal specimen. A new stress-analysis tool, acoustoelasticity (*PE—July 20, p 56*), reveals internal stresses without destroying the part. If a method could be found which would reveal "stress marks"—deformations in grain orientation because of previous stresses—it could be useful to the test engineer and metallurgist. Ideally, a chemical would be applied to the surface, without etching it, to give a kind of topographic map of the grain direction. One application: coin collectors would be able to bring out worn off dates and marks. —J W SEGLAZ

. . . a flexible head for drinking fountains to prevent broken teeth, cut lips, and other accidental injuries. During the war, a plastic head was made and sold, but proved much too fragile. A prominent manufacturer of drinking faucets advises, "At the present time, we do not know of anyone who manufactures a plastic head. The primary reason is that they don't stand up to the abuse and hard wear of the average public or school installation. Even the brass ones are quickly broken or destroyed." —J K KAHN

Have you a problem, based on known scientific principles, which seems to have an answer somewhere within the limits of present technology? To inspire inventors along worth-while paths, PRODUCT ENGINEERING invites you to trade such problems with fellow readers who may have a fresh viewpoint or more time for necessary R & D. We will pay $10 for each one accepted.

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6	13	20	27	34	41	48	55	62	69	76	83	90	97	
7	14	21	28	35	42	49	56	63	70	77	84	91	98	

SIGNIFICANT PARTS and NEW LITERATURE

101	106	111	116	121	126	131	136	141	146
102	107	112	117	122	127	132	137	142	147
103	108	113	118	123	128	133	138	143	148
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Publisher's Postscript...

Engineering with glamor

Publishing a magazine every week develops a sense of urgency in editors that simply does not exist on magazines that permit a more leisurely pace. In fact, when deadline and press time approaches our editors sometimes act more like old-time newspapermen than old-time newspapermen. It's impressive to visitors, of course, but I secretly suspected there was more than a little overacting involved. Now I'm not so sure.

Editors attend press conferences, they go on plant tours, interview engineers, then come home to write it up. What's so glamorous about that?

Well, Ben Leerburger, who writes "Interesting To Note," got lost in the Egyptology section of the Metropolitan Museum of Art the other day while he was looking for a stone duck used by Cleopatra and her pals as a weight standard. He also had the doubtful pleasure of eating a completely dehydrated meal in a submarine in order to test a compact galley design for serving space-saving food. His comment? A bit dry.

Jerry Lynch spent a day aboard a Navy blimp to cover a magnetic air-detection unit and an underwater drill.

News editors have been on ships and in armored tanks. They've played war games on computers and got lost in the Pentagon. Their travel schedules include London, Milan, Paris, Berlin (and East Germany—see p 38) as well as every major and most medium-sized cities in the US.

They got friendly with some Russian engineers working at the Soviet exhibition in New York last month and invited them in to lunch and for some shop-talk. The lunch grew to a party of 18 so they reserved a private dining room, and spent most of the afternoon asking questions and getting answers—and more questions in return.

This led to a second get-together at the home of one of our editors to show the visitors how we live. They were suitably impressed by the refrigerator and electric stove. They had a wonderful time with the gas-powered lawn mower. But American automobiles lost some prestige. A dead battery delayed them for over an hour on the trip back.

Engineering and editing make my job as publisher seem pretty dull sometimes. —SJA

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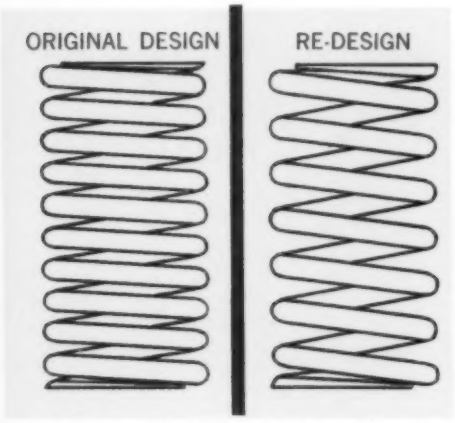
70 POUNDS OF SPRINGS

were just going along for the ride!



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130 lbs. of wire per
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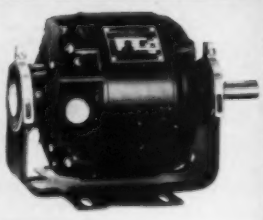

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